

THE ROLE OF FAMILY ENVIRONMENTAL FACTORS ON ADHD AND ODD COMORBIDITY IN EARLY
CHILDHOOD

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ABSTRACT

Seungeun Lee: The Role of Family Environmental Factors on ADHD and ODD Comorbidity in Early Childhood
(Under the direction of Roger Mills-Koonce, PhD)

Attention Deficit Hyperactivity Disorder (ADHD) and Oppositional Defiant Disorder (ODD) are the two most common childhood behavioral disorders (Biderman & Faraone, 2005) with a high comorbidity rate (Angold et al., 1999). As comorbidity first emerges in early childhood, effects of family environmental factors (e.g., maternal sensitivity, maternal harshness, corporal punishment, and intimate partner violence) are crucial in understanding the development of comorbidity (Johnston & Jassy, 2007). This study sought to fill gaps in research on comorbidity between ADHD and ODD in early childhood.

This dissertation is a passive longitudinal design with specific time points that used a secondary data analysis on the Family Life Project (Wagner, Mills-Koonce, Willoughby, Zvara, & Cox, 2015). The sample included 878 children with their mothers from rural counties of North Carolina and Pennsylvania. This current study examined group differences (e.g., children with comorbidity, children with ADHD only, children with ODD only, and health control) in family environmental factors and its role as potential moderators on comorbidity.

Aligned with developmental precursor model, family environmental factors have been identified with its unique contribution to ADHD and ODD comorbidity in early childhood. Results in this study indicated that there were 1) significant group differences in family environmental factors based on the group membership; 2) significant buffering effect of maternal sensitivity associated with the comorbidity; 3) significant association between maternal negativity with later ODD development moderated by varying level of ADHD symptoms in children. Implications and recommendations for research and practice are discussed.

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CHAPTER 1: INTRODUCTION

Attention Deficit Hyperactivity Disorder (ADHD) and Oppositional Defiant Disorder (ODD) are two of the most prevalent mental health disorders in children (Johnston and Mash, 2001). ADHD affects approximately 8-12% (Faraone & Biederman, 2005), and ODD affects about 10% of the population (Nock, Kazdin, Hirpi, & Kessler, 2007) in US and comorbidity between two disorders are as high as 60% (Angold, Costello & Erkanli, 1999). This unusually high comorbidity has been noted in numerous studies (Costello, Mustillo, & Erkanli et al., 2003; Nock et al., 2007) and adverse outcomes commonly associated in both disorders such as poor school functioning (Greene, Biederman, Zerwas, Monuteaux, Goring, & Faraone, 2002) and negative parent-child relationship (Johnston and Mash, 2001; Waschbusch, 2002) significantly threatens children's development and well-being.

In order to understand this high comorbidity under the developmental psychopathology framework, which highlights ongoing interactions of developmental processes between protective and risk factors in the environmental context (Johnston & Jassy, 2007), the developmental precursor model was suggested to explain the comorbidity. The model suggests that early symptoms of ADHD in children put stress on parental functioning and further lead to disruption in family dynamic that ultimately heightens the risk for ODD in children (Johnston & Jassy 2007; Harvey et al., 2016). In other words, the developmental precursor model suggests that symptoms of ADHD serve as a precursor, and various familial contextual factors may function as moderators in the development of ODD.

When examining different familial factors that have an impact on the comorbidity as either risk or protective factors, different parenting style (e.g., maternal sensitivity and maternal harshness), as well as direct and indirect exposure to family violence (e.g., use of corporal punishment and exposure to IPV), have been documented in the literature (Johnston & Jassy 2007; Harvey et al., 2016). Further examination of each family factor, studies have noted the distribution of maternal sensitivity, and the rest of the factors differ (Johnston & Jassy 2007). The difference in distribution is directly linked with its role as a protective and risk factor. For instance, assuming normal distribution with two tails at each end, maternal sensitivity can function as both risk (e.g., low maternal

sensitivity) and protective (e.g., high maternal sensitivity) in the development of ODD symptoms for children. However, this is not true for other family factors such as maternal negativity, use of corporal punishment, and exposure to IPV as we expect the absence of these negative family context as standard or baseline. Therefore, we would expect positively skewed one-tail distribution for these family factors and consider how they impact as an only risk factor to the development of ODD symptoms for children. Overall, literature using family factors like risk and protective factors influencing comorbidity in early childhood is very limited and has mixed results due to wide variability in defining and measuring constructs (Vu, Jouriles, McDonald, & Rosenfield, 2016).

Despite the well-established co-occurrence, theoretical model for comorbidity, and negative consequences related to each disorder (Nock et al., 2007; Johnston & Jassy 2007; Waschbusch, 2002), there are three critical gaps in the literature on this topic; First, there is limited number of studies looking at young children (Harvey, Breaux, & Lugo-Candelas, 2016) despite the critical role of family factors play in social-emotional development in early childhood (Denham, 2006); Second, although evidence from recent studies suggests that ODD is a distinctive disorder in its own; literature often combines ODD and CD when examining impact of comorbidity with ADHD (Moffitt, 1993; Rowe, Costello, Angold, Copeland, and Maughan, 2010). As a result, relatively little attention has been given to protective and risk family factors specific to ADHD and ODD (Rowe et al., 2010). Finally, previous and current research focuses on a better understanding of family protective and risk factors related to each disorder (e.g., ADHD and ODD separately), but not with a combination of both disorders. Further research is needed to understand the important family-related protective and risk factors concerning the co-occurrence of these specific disorders (e.g., ADHD and ODD) in early childhood.

Therefore, this study will utilize a developmental precursor model under the framework of developmental psychopathology (Johnston and Mash, 2001) to describe familial protective and risk factors related to ADHD and ODD comorbidity in young children. Potential findings from this study will provide a more in-depth understanding of comorbidity and contribute to prevention and intervention efforts for children and their families.

CHAPTER 2: LITERATURE REVIEW

ADHD and ODD Comorbidity

Attention Deficit Hyperactivity Disorder (ADHD) is one of the most common childhood neurobehavioral disorders and is characterized by a persistent pattern of inattention and hyperactivity and/or impulsivity across multiple settings (American Psychiatric Association, 2013). ADHD is estimated to affect eight to 12% of the population in US (Faraone & Biderman, 2005) and it is widely known that ADHD can cause significant stress in parent-child relationship (Johnston and Mash, 2001), poor academic achievement (Beauchaine, Hinshaw & Pang, 2010), and suboptimal social functioning with peers (Kaiser, McBurnett, & Pfiffner, 2011). In recent years, significant advances have been made in understanding the neurological basis of this disorder and as a result, multiple genes have been accounted largely for the onset of ADHD (Azeredo, Moreia and Barbosa, 2018). Although the onset of ADHD is largely biological basis, many empirical studies emphasize the importance of environmental factors such as family dynamics (e.g., exposure to violence at home) and parenting behaviors (e.g., maternal sensitivity and maternal harshness) in the maintenance and manifestation of ADHD (Johnston and Mash, 2001; Azeredo et al., 2018). Furthermore, potential negative consequences and impairments that can be caused by ADHD are exacerbated by its high comorbidity with other childhood psychiatric disorders such as oppositional defiant disorder (ODD) (Angold et al., 1999; Waschbusch, 2002), conduct disorder (Beauchaine et al., 2010), and emotional disorders such as anxiety and depression (Costello et al., 2003). Not surprisingly, the prognosis is more severe when ADHD is comorbid with other forms of disruptive behavioral disorders such as ODD and/or CD (Waschbusch, 2002). Among several childhood onset disorders that have high comorbidity with ADHD, ODD has the highest comorbidity with ADHD, as high as 60% comorbidity (Angold et al., 1999; Maughan, Rowe, Messer, Goodman, & Meltzer, 2004). Like ADHD, ODD is also a common mental health disorder in early childhood and its lifetime prevalence rate is estimated approximately 10% of the US population (Nock, Kazdin, Hirpi, & Kessler, 2007). ODD is characterized by a persistent pattern of defiance, argumentativeness, and irritation (APA, 2013). Contrary to

ADHD, both genes and environmental factors have been discussed as critical for the onset of ODD (Burt et al., 2001; Tuvblad, Zheng, and Baker, 2008). For example, a chaotic family environment such as exposure to marital conflict or physical abuse has been significantly associated with the onset of ODD in young children (Tuvblad, Zheng, and Baker, 2008). Regardless of differences in etiology, ODD is significantly associated with adverse outcomes in children such as poorer family cohesion (Burke, Rowe, and Boylan, 2014); more negative parenting practices (Tolan, Dodge, & Rutter, 2013); and suboptimal functioning at school (Greene et al., 2002).

Given that the co-occurrence of ADHD and ODD far exceeds that expected by chance (Rowe et al., 2010), it is important to examine possible explanations (e.g., shared familial risk factors and directionality between the two disorders) underlying the comorbid pattern in order to further understand etiology and developmental pathway of each disorder (Caron and Rutter, 1991). Although there is a wealth of literature looking at each disorder separately and some literature about the comorbid risk factors between ADHD and ODD combined with CD, relatively little attention has been given to comorbid risk factors specific to ADHD and ODD alone (Rowe et al., 2010). This may be because most of the comorbidity research focuses on older school age children or adolescents and CD tends to be diagnosed around this developmental period. Additionally, CD is typically viewed with more serious implications later in adulthood such as antisocial personality disorder and substance abuse compared to ODD (Moffitt, 1993; Lahey, Van Hulle, Rathouz, Rodgers, D'Onofrio & Waldman, 2009; Tuvblad, et al., 2008). Although past studies indicate ODD as a precursor to CD or mild form of CD (Burke et al., 2002), recent studies suggest ODD may not always be a significant precursor to CD and the two disorders have distinct psychological pathways with ODD implying its own consequences (Rowe et al., 2010; Nock et al., 2007). Therefore, past research combining ODD with CD and examining its comorbidity with ADHD in children may not be an accurate reflection of children with ADHD and just ODD.

With a lack of comorbidity research specifically dedicated to ADHD and ODD in early childhood, researchers and scholars attempted to explain the causality behind the high comorbidity with different theoretical models (Moffitt, 1993; Johnston and Jassy, 2007). The developmental precursor model is one of the theoretical models within the developmental psychopathology framework that attempts to answer causality behind the high comorbidity of these two disorders. First, a developmental psychopathology framework is a framework that highlights ongoing interactions of developmental processes between protective and risk factors in the environmental context (Johnston & Jassy, 2007). As one of many possible processes and interactions that involve different risk and

protective factors, the developmental precursor model suggests that early symptoms of ADHD put stress on family and lead to disruption in family functioning that ultimately heightens the risk for ODD in children (Johnston & Jassy 2007; Harvey et al., 2016). In other words, the developmental precursor model suggests that symptoms of ADHD serve as a precursor, and various familial environmental factors function as mediators in the development of ODD. Following this promising theoretical model, Nock and his colleagues found that clinically elevated levels of ADHD symptoms in early childhood predicted later ODD symptoms in adolescence (Nock et al., 2007). Nock and his colleagues (2007) examined the lifetime prevalence, onset, and maintenance of ODD retrospectively using the National Comorbidity Survey Replication responses from 3,199 adults. The responses for the study were collected via survey using the World Health Organization (WHO) Composite International Diagnostic Interview (CIDI; Kessler & Ustun, 2004) of ODD symptoms as well as other mental health disorders commonly co-occur with ODD (i.e., ADHD). Similarly, a significant continuity from ADHD to ODD was found in children age nine through 16 in a longitudinal study examining the prevalence and continuity of different psychiatric disorders (Costello et al., 2003). A total of 1,420 children participated in the study, and it emphasized comorbidity and unique developmental pathways for different psychiatric disorders common in children (Costello et al., 2003). Of note, although directionality from ADHD to ODD was supported, the reverse was not supported (Costello et al., 2003). Rather than simply stating comorbidity, this result implies directionality, which is congruent with the developmental precursor model. Although these two studies did not identify causality or specific family factors contributing to comorbidity, both studies identified the directionality (e.g., ADHD as a precursor to the development of ODD) that supported the developmental precursor model.

Despite the high comorbidity between two disorders and well-established theoretical framework and model attempting to explain such comorbidity, there is a limited amount of studies that focuses on the comorbidity of ADHD and ODD in early childhood (Harvey et al., 2007; Riddle et al., 2013). A potential explanation for this gap is that problems with behavioral management become more noticeable when children first enter grade school and consequently, children tend to only receive their first diagnoses related to disruptive behavioral disorders (e.g., ADHD or ODD) at this time and consequently, adverse effects of these disorders focus on later school age or adolescence (Harvey et al., 2007). Early childhood, which typically ranges from three to eight years old, is a critical period for socio-emotional development in children (Denahm, 2006). As parents represent one of the earliest and proximal figures that constantly affect child development, it is not surprising that parenting behavior and family

functioning can potentially serve as important environmental or contextual factors for developmental outcomes in children (Riddle et al., 2013). It is also important to note that during this early childhood period, children also begin to show symptoms of ADHD and ODD (Johnston & Mash, 2001). Given the high prevalence of co-morbidity of ADHD and ODD in early childhood, the role of parenting behaviors and family functioning become vital considerations in childhood development (Denham, 2006).

In sum, the current study will add to the literature discussed above by describing differences in familial factors across children with and without ADHD and ODD in early childhood. Early childhood is periodically defined as the early preschool years ranging from two years of age to six years of age (Harvey et al., 2016). This period may be especially relevant given that symptoms for both disorders are reported to first emerge during the preschool year yet there are not sufficient studies focusing on this period (Harvey et al., 2016; Riddle et al., 2013). As family functioning is known to have significant influence in socio-emotional development during this period (Denham, 2006) and its disruption can heighten the risk of developing ODD symptoms as the developmental precursor model suggests (Johnston & Jassy, 2007), examining various familial factors such as use of positive and negative parenting style, use of corporal punishment, and presence of intimate partner violence, may be crucial to understanding the comorbidity. Therefore, following sections of the literature review will focus on summarizing past research on these familial factors for children with ADHD, ODD, and comorbid ADHD and ODD.

Family Environmental Factors and ADHD

Briefly introduced in the previous section, ADHD is one of the most common neurological disorders in childhood. As a result, much attention in research is given to identifying the underlying neurological cause behind inattention, impulsivity, and hyperactivity in children (Azeredo, et al., 2018). Although no single genetic or neurological factor has been identified that causes ADHD, Zhang and his colleagues reported that the onset of ADHD is heavily influenced by genetics, up to approximately 76%, by multiple genes, including dopamine transporters (i.e., SLC6A3, DRD4, and DRD5) and serotonin receptor genes (i.e., SLC6A4 and HTR1 B) (Zhang, Pant, & Logan, 2011). In a more recent systematic review, Azeredo and his colleagues identified 279 studies published between 1985 to 2017 and included 17 studies for final analysis to know more about genetic and environmental influences on the development of ADHD. Findings from this study also indicate a consensus among empirical studies that there is a strong genetic influence, perhaps stronger than the impact of environmental factors, contributing to the onset of ADHD (Azeredo et al., 2018). However, researchers acknowledged the importance of

environmental factors in the maintenance and manifestation of ADHD with other common comorbid disorders. Specifically, the researchers were able to observe that symptoms originating from ADHD disrupt family factors such as increased parental stress and negative family dynamics, which consequently exacerbate ADHD symptoms and contribute to the development of ODD symptoms (Azeredo et al., 2018). The researchers in this study concluded that the onset of ADHD in childhood is heavily influenced by genetic factors, and these biological factors lead to a predisposition to ODD later in adolescence. However, the manifestation of ODD can vary with the impact of environmental factors such as family functioning and parental disciplinary style (Azeredo et al., 2018). It seems clear that ADHD is familial and heritable in its onset, while environmental factors seem to hold the key to maintenance and manifestation of ADHD with other comorbid disorders such as ODD.

Therefore, this section will review four-family factors (e.g., maternal sensitivity, maternal harshness/intrusiveness, corporal punishment, and intimate partner violence) that are associated with the children who have ADHD.

Maternal Sensitivity and ADHD. In the context of parental discipline, Deater-Deckard (2006) and his colleagues defined maternal warmth or sensitivity as “a positive receptivity toward a child’s needs and tendencies and a positive disposition toward the child.” With this definition, maternal sensitivity has been mainly viewed as a protective factor in child development (Deater-Deckard, Ivy, & Petrill, 2006). However, maternal sensitivity can also be considered a risk factor for childhood behavioral problems, as a low level of maternal sensitivity can be translated into a lack of positive receptivity or interchange between mother and child (Deater-Deckard et al., 2006). Unfortunately, only a handful of studies examine maternal sensitivity as both protective and risk factors in context of early childhood ADHD (Keown, 2011; Johnston, Murray, Hinshaw, Pelham, and Boza, 2000).

According to a study conducted by Johnston and colleagues (2000) observing mother-child interaction of 136 families of 7-10-year old boys with ADHD, no significant relation was found between maternal responsiveness or sensitivity and ADHD symptoms of boys (Johnston et al., 2000). In this study, mother-son interaction was videotaped using one-way mirror room, and mothers were instructed with four situations (e.g., free play, parent busy, paper and pencil, and cleanup). Maternal sensitivity was coded in the context of the child’s needs and developmental level, in particular to different situations presented (Johnston et al., 2000). Low maternal sensitivity was not found to have any significant influence or function as a significant risk factor for boys with ADHD symptoms only. However, it is important to note that this study restricted participants to boys only and did not

examine maternal sensitivity with comparison groups such as children with only ODD or a controlled group of children without either diagnosis. Although maternal sensitivity was not a strong risk factor in ADHD symptoms, researchers indicated a positive correlation between low maternal sensitivity and boys with both ADHD and CD (Johnston et al., 2000). Together, it could potentially mean that maternal sensitivity is a risk factor only in ADHD with other disruptive behavior disorders.

On the contrary, Keown (2011) conducted a three-year longitudinal study examining the effect of maternal sensitivity in preschool-aged boys on predicting later school-age development of ADHD.. A total of 93 boys and their mothers who participated in the study were recruited by participating preschools using Strengths and Difficulty Questionnaire (SDQ; Goodman 1999) and Parental Account of Children's Symptoms (PACS; Woodward, Taylor, & Downey 1998). Home visits were made at two time points, and trained coders observed parent-child interaction. Keown (2011) reported that the presence of high maternal sensitivity in preschool mother-son interaction was associated with less inattentiveness by maternal rating and less hyperactive/impulsivity by teachers (Keown, 2011). Therefore, this study provides evidence that high maternal sensitivity can serve as a potentially protective role in children's ADHD symptoms.

Together, it seems that existing literature supports the protective role of maternal sensitivity in reducing ADHD symptoms (Keown, 2011). At the same time, it may not be a strong enough risk factor to exacerbate ADHD symptoms without any comorbid behavioral problems (Johnston et al., 2000). However, it will be essential to consider how maternal sensitivity affects both genders and with other comparison groups such as health control and children with just other disruptive behavior disorder diagnosis to clarify the relationship between maternal sensitivity and ADHD symptoms in children.

Maternal Harshness/Intrusiveness and ADHD. By definition, children with ADHD present a unique challenge to parents with their high activity, impulsiveness, and short attention span (Zhang et al., 2011). Due to these traits associated with ADHD, parents of these children frequently experience high levels of distress related to managing their child's disruptive behavior in multiple settings (Azeredo et al., 2018). Specifically, one study suggests a significant association between a child's ADHD symptoms with maternal harshness (Johnston & Mash, 2001). Johnston and his colleague reviewed various family factors, including maternal harshness, on a child's ADHD symptoms in the context of a developmental psychopathology framework (Johnston & Mash, 2001). In this framework, high maternal harshness or intrusiveness are described as risk factors exacerbating ADHD-related

behaviors in children (Johnston & Mash, 2001). Johnston and Mash (2001) described mothers of children with ADHD as more frequently react and give attention to children's overactive and impulsive behaviors by using repeated commands, more verbal reprimand and corrections compared to mothers of neurotypical children. Mothers of children with ADHD also reported greater psychological distress and perceived less support from their family than the control group, and this may be associated with higher maternal harshness and intrusiveness in the ADHD group (Johnston and Mash, 2001).

In contrast, Gomez and Sanson (1994) conducted an observational study examining mothers' interactions with their children who had comorbid ADHD and ODD compared to ADHD only and healthy control children. Research indicated that significant negative interactions such as intrusiveness and negative controlling behaviors in mothers with the comorbid condition compared to children with ADHD alone and healthy control children. Surprisingly, no significant difference was found between mothers of healthy control and ADHD alone children group (Gomez and Sanson, 1994).

Therefore, the relationship between maternal harshness and ADHD symptoms seems to have a mixed result in literature. There is evidence that parents of children with ADHD experience higher levels of parental stress compared to parents of neurotypical children due to children's lack of self-management, and this stress creates an adverse effect on parenting functioning, which in turn increases maternal harshness (Johnston & Mash, 2001). However, there is also evidence that families of ADHD only children do not differ significantly compared to a healthy control group in terms of their association with maternal harshness (Gomez and Sanson, 1994).

As the presence of ADHD symptoms can be potentially associated with increased maternal harshness, studies examining families of children with ADHD also suggest that symptoms of ADHD in children can cause further disturbances in the family dynamic and marital functioning (Johnston & Mash, 2001). According to Johnston and Mash (2002), disturbances in family and marital functioning can be divided into two different types of family violence in terms of their proximal and distal effect to children: direct and proximal forms of family violence (e.g., corporal punishment) and indirect and distant forms of family violence (e.g., intimate partner violence).

Corporal Punishment and ADHD. Although there is a wealth of literature available indicating short-term and long-term negative consequences of physical abuse (i.e., childhood maltreatment), including childhood behavioral problems and delinquencies, it is often difficult to differentiate in literature between physical abuse, which is considered childhood maltreatment, and the use of corporal punishment, which is not strictly considered

childhood maltreatment (Gershoff, 2002; Saunders, 2003). The use of corporal punishment is considered one of the highest risk factors and a high co-occurring condition that leads to physical abuse (Gershoff, 2002). As such, terminologies are used interchangeably in research, which leads to difficulty accurately understanding the effect of corporal punishment alone versus the combined effect with physical abuse (Gershoff, 2002). Perhaps due to this difficulty, variations in defining corporal punishment and the relationship between corporal punishment and ADHD symptoms in childhood are mixed in the literature.

For example, Whitmore and her colleagues (1993) designed a study to see the relationship between punitive parenting on behavioral characteristics of ADHD children. The researchers compared the reporting of childhood physical punishment and discipline in the home environment between adult males with and without ADHD (i.e., male siblings in the same household without ADHD) (Whitmore, Kramer, and Knuston, 1993). The experimental group of participants (e.g., children with ADHD) was selected from a larger longitudinal study between 1967 and 1978 in Iowa, predominantly consisting of individuals with a history of referral or treatment for ADHD symptoms in their childhood. The researchers hypothesized that the experimental group would report more physical punishment, harsher discipline, and more parental rejection compared to their non-ADHD brothers based on previous studies supporting the association of physical abuse and hyperactive children. Surprisingly, Whitmore and her colleagues found no significant differences in physical discipline and punishment between siblings (Whitmore et al., 1993). However, it is crucial to keep in mind that this is a retrospective study relying on a childhood memory.

In contrast, in a more recent study looking at the relationship between physical discipline in families of 125 children with ADHD in Iran, Alizadeh and his colleagues (2007) found that parents of children with ADHD used physical discipline significantly more compared to parents of children without ADHD (Alizadeh, Applequist, and Coolidge, 2007). Children were identified using Conners' Parent Rating Scale, and Teacher Rating Scale (Conners, Parker, Sitarenios, & Epstein, 1998) in participating schools and parents were later given the Parenting Styles and Dimensions Questionnaire (PSDQ, Robinson, Mandelco, Olsen, & Hart, 2001) that includes questions related to using of corporal punishment. Although corporal punishment was an effective means to achieve immediate compliance, given the high comorbidity between corporal punishment and physical abuse, the result of this study is alarming.

IPV and ADHD. Children's exposure to an indirect and distant form of family violence, or exposure to parents' intimate partner violence (IPV), can be explained well using a developmental psychopathology framework. As previously discussed, this framework is grounded on the importance of context and interaction of multiple events to facilitate adaptive and maladaptive development (Johnston & Jassy, 2007). When children are exposed to an indirect and distal form of family violence, such as IPV, this framework takes into account the environmental context on the child's ongoing development. From this perspective, children's internalizing and externalizing problems associated with exposure to IPV are understood as children's efforts to adapt to a maladaptive situation (Johnston & Jassy, 2007). In the United States, an estimated ten million children live in homes with IPV. Still, only a few studies point out that children under six years of age are a significant portion in this number and are more likely affected by such negative family context than older children and adolescents (Carpenter & Stacks, 2009; Kitzmann et al., 2003). Such a gap in the literature may be since diagnosis of ADHD usually occurs around when a child enters grade school, and this is also the time when behavior management in school becomes important (Carpenter & Stacks, 2009). In addition to this gap, there is also difficulty defining intimate partner violence similar to difficulty defining corporal punishment. While some studies focus solely on witnessing physical abuse between caregivers, other studies have a broader definition that includes verbal and emotional abuse between caregivers — having such inconsistency in defining terminologies also contributes to difficulty in comparison among studies (Vu, Jouriles, McDonald, & Rosenfield, 2016).

Despite the deficiency in the literature that focuses on children under the age of 6 and lack consistency in the operational definition of IPV, there is clear evidence that the presence of IPV exacerbates symptoms of ADHD in early childhood. Becker and McCloskey (2002) conducted a longitudinal study at two-time points (e.g., 1990-1991 and 1996-1997) to examine how IPV exposure contributes to the development of attention and later conduct problems in children. At Time 1, mothers ($n = 287$) were interviewed using CTS (Conflict Tactic Scale) to assess marital violence and the Child Assessment Schedule (CAS) to determine attention-deficit/hyperactivity in their children (aged 6 to 12). At time 2, adolescents who participated at time one were interviewed for delinquency or violent behaviors. Findings from this study indicate that although there was no significant association between adolescent conduct problems and childhood IPV exposure, exposure to IPV in childhood was a strong predictor of attention problems in both boys and girls (Becker & McCloskey, 2002). The significant association between

exposure to IPV and attention problems in both genders supports the hypothesis that disruptive family dynamics can contribute to the development of attention problems in children.

A more recent study supporting a significant association between IPV exposure and childhood ADHD is a prospective cohort study conducted by Bauer, Gilbert, Carroll, and Downs (2013) that examined the effect of exposure to IPV within the first three years of children's life. A total of 2422 children and their mothers were recruited from four community health centers in Indiana between 2004 to 2012. (Bauer et al., 2013). Researchers screened for IPV using questions presented in a prescreened form such as "Has your partner kicked, hit, or slapped you" and "Do you feel safe in your home?" 69 out of 2422 mothers reported exposure to IPV, and the study's significant finding was that children of mothers who reported experiencing IPV in their child's first two years of life had increased odds of having an ADHD diagnosis between three and six years of age (Bauer et al., 2013).

In conclusion, the overall pattern of research findings on the effect of IPV exposure to ADHD development indicates that exposure to IPV was a definite risk factor for ADHD development in children.

Family Environmental Factors and ODD

This section will review four family factors (e.g., maternal sensitivity, maternal harshness/intrusiveness, corporal punishment, and intimate partner violence) that are associated with children who have ODD symptoms.

In literature, behaviors that align with ODD symptoms in children, such as noncompliance, aggression, defiance, and delinquent behaviors, are usually combined as a single cluster and described as externalizing behaviors or problems (Dodge, Coie, & Lynam, 2007). As a result, most research studies in developmental psychopathology examine the relationship between externalizing behaviors and family factors rather than specific disorders (e.g., ODD) and family factors.

Maternal Sensitivity and ODD. To emphasize the importance of parenting styles and childhood externalizing behaviors, Tolan and his colleagues (2013) identify parenting disciplinary style as one of the most influential factors among environmental variables that could contribute to the development of externalizing behaviors in children (Tolan, Dodge, & Rutter, 2013). Similar to the previous section regarding maternal sensitivity and ADHD, maternal sensitivity can be viewed as both a protective and risk factor in terms of the development of disruptive behavior disorder such as ODD.

Deater-Deckard, Ivy, and Petrill (2006) looked at how maternal sensitivity contributes to the relationship between externalizing behaviors, such as aggression and noncompliance in children, and parental use of physical

discipline. In this study, 297 of three-to eight-year old children in 169 families participated, and parents of these children completed rating scales measuring child externalizing problems and their sensitivity toward these children. The parents were also interviewed and rated on their discipline style and use of physical discipline. The major finding of this study indicates that increased maternal sensitivity served as a protective factor against an existing positive association between physical punishment and externalizing behaviors (Deater-Deckard et al., 2006). The study provides evidence of the potential and indirect protective role of maternal sensitivity in the development of child externalizing behaviors. The researchers hypothesize that high levels of parental sensitivity and involvement may contribute to the development of a child's interpersonal skills, such as negotiation or conflict resolution skills, that ultimately result in less noncompliance or further behavioral problems (Deater-Deckard et al., 2006).

On the other hand, a study conducted by Stormshak, Bierman, McMahon, and Lengua (2000) reported a positive association between low parental warmth or sensitivity and childhood disruptive behaviors that are similar to symptoms of ODD (i.e., aggression, noncompliance, and oppositional behaviors). In this study, 631 kindergartners and their mothers participated in-home interviews that measured five different parenting practices, such as parental warmth or sensitivity, consistency, punitive discipline, spanking, and physical aggression (Stormshak et al., 2000). The population consisted of predominantly low to mid-SES African American families and children were identified as high-risk through multiple measures and observations conducted by participating school teachers (Stormshak et al., 2000). Given the positive association between low maternal sensitivity and increased aggression and oppositional behaviors in the result of this study, researchers indicated that low maternal sensitivity might serve as a significant risk factor in developing disruptive behavioral profiles similar to ODD in children (Stormshak et al., 2000). Stormshak and her colleagues suggest that this result may be explained by the inverse association between parental sensitivity and child's sense of security and emotional regulation abilities that were indicated in other studies (Stormshak et al., 2000; Pettit & Bates, 1989). It seems that lack of positive interchanges and attention between mother and child threatens a child's ability to build a healthy attachment with their mother and ultimately results in insecure attachment (Pettit & Bates, 1989). In turn, such insecure attachment leads to disruptive behaviors in children, such as argumentativeness, defiance, and irritation.

In summary, maternal sensitivity seems to serve as a distinct and essential contributor in externalizing problems in children, both as a protective measure (e.g., high maternal sensitivity) and risk factor (e.g., low maternal sensitivity) to childhood disruptive behavior consistent with profiles of ODD.

Maternal Harshness/Intrusiveness and ODD. Maternal harshness or intrusiveness have been consistent correlates with childhood disruptive behavior in parenting programs and have been conceptualized as “excessive and controlling parental attention and knowledge about child’s behavior including safety and other social relations” (Tolan et al., 2013).

A seminal study conducted by Patterson and his colleague (1992) related to coercive parenting and behavioral problems in childhood demonstrates a well-established relationship between coercive parenting or maternal harshness and externalizing behaviors in children. In their longitudinal study of over 200 boys, Patterson and colleagues found that parental coercion and inconsistent discipline, similar to maternal harshness and intrusiveness, increased aggressive behavior compared with controls (Patterson, Reid, & Dishion, 1992). According to Patterson, negative parenting and children’s difficult behaviors can interact and reinforce each other. With time, the coercive cycle strengthens and escalates the negative interaction between mother and child (Patterson et al., 1992). Patterson’s coercive interaction model (1992) shows how maternal harshness, which he conceptualizes as intermittent and inconsistent responses to misbehaviors, can have a significant impact on developing disruptive behavioral problems in children. Similarly, another seminal study conducted by Garnder (1994) supports this model in that she observed that mothers of preschool children with behavioral issues lacked inconsistent follow-through in their commands compared to mothers of preschool children without any behavioral problems (Gardner, 1994). This ultimately creates noncompliant behaviors from children with confusion and frustration that look similar to the ODD symptom profile.

The study conducted by Stormshak and her colleagues (2000) described above also looks at maternal harshness as one of the independent variables in different types of parenting practices. For instance, punitive disciplines such as yelling, nagging, threatening, and inconsistent disciplines are similar constructs to maternal harshness and intrusiveness. Consistent with previous research and literature, elevated levels of punitive discipline and inconsistent discipline contributed to the development of aggressive and oppositional behaviors in children (Stormshak et al., 2000). Researchers suggest that children with high-risk profiles similar to this study’s sample (e.g., noncompliant, aggressive, and oppositional behaviors) are more likely to receive punitive discipline because managing problematic behaviors is challenging for the parents (Stormshak et al., 2000).

Finally, Cunningham and Boyle (2002) observed mother-child interaction at home and asked to suggest a solution to behavioral problems such as noncompliance and oppositional behaviors. Based on the literature review,

the researchers hypothesized that mothers of children at risk for ODD would show less effective child management solutions, marked by inconsistency and harshness because more coercive and negative parenting strategies would be reflected in mothers' knowledge of child behavior management. The findings of the study confirmed this hypothesis. They indicated that mothers of children at risk for ODD suggested twice as many controlling and negative behavioral management strategies as positive or preventive strategies than mothers in the control group (Cunningham & Boyle, 2000). Researchers explain that the result may be due to mothers of high-risk children feeling less competent as parents compared to mothers of low-risk children (Cunningham & Boyle, 2000).

In summary, it is clear from existing literature that maternal harshness and intrusiveness are positively associated with the development of externalizing problems in children.

Corporal Punishment and ODD. As mentioned in the previous section, the use of corporal punishment is prevalent in the US, and such high prevalence brought a lot of attention from researchers studying the effect of corporal punishment in childhood. Consequently, empirical studies on this topic are extensive. However, the impact of corporal punishment on childhood externalizing behaviors is somewhat mixed as there is a wide variation in defining corporal punishment in research and literature.

One of the most comprehensive reviews of the literature on the relationship between parental use of corporal punishment and child outcomes is a meta-analysis conducted by Gershoff (2002). In her review of 88 empirical studies examining the relationship between corporal punishment and children's adjustment through the presence of internalizing and externalizing disorders, she found several negative behaviors and emotions related to corporal punishment in children. For example, despite the large effect size on immediate compliance to parental commands, the use of corporal punishment showed a positive association with negative child behaviors such as aggression, delinquent behaviors, and further becoming a victim of child physical abuse (Gershoff, 2002). Furthermore, Gershoff identified a positive association between corporal punishment in childhood with more severe problems in adulthood, including aggression, criminal behaviors, and abuse of spouse and child. This potentially long-term effect on adulthood and the possibility of generational transmission of violence is noteworthy and alarming enough to learn more about the impact of corporal punishment in childhood.

However, some researchers have argued that corporal punishment is not associated with increased child externalizing problems if the punishment is infrequent and not severe. For example, Baumrind, Larzelere, and Cowan (2002) conducted a re-analysis of studies included in Gershoff (2002) meta-analysis because the researchers

argued that frequent and severe levels of physical punishment such as slapping in face or hitting a child with objects on their bare skin had different effect than light and infrequent punishment or “ordinary physical punishment” such as occasional spanking with open hand on clothed bottom (Baumrind et al., 2002). The researchers thought that more frequent and severe levels of corporal punishment should be considered child abuse instead of corporal punishment. They pointed out a limitation in the conceptual and operational definition of corporal punishment in Gershoff’s (2002) analysis. Instead, Baumrind and his colleagues suggested that physical discipline should be understood as a conditional sequence model where parents start with the mildest disciplinary method, such as verbal reasoning, and move up to a stronger method if a child remains noncompliant. They further argued that parents with children between the ages of two and six who use infrequent and mild spanking in the context of other forms of disciplinary strategies could have positive effects such as immediate compliance and reduced aggression as children learn to attain reasonable behaviors with the mild disciplinary method over time (Baumrind et al., 2002). Overall, the researchers concluded that Gershoff’s meta-analyses do not justify claimed adverse childhood behavioral problems when mild to moderate corporal punishment are considered.

Taken together, it is clear that severe and frequent forms of corporal punishment have a negative effect and lead to the development of childhood externalizing problems (e.g., aggression, irritation, and hostility) similar to symptoms of ODD. However, despite the extensive amount of research, inconsistency in defining corporal punishment in terms of its intensity and frequency and its overlapping definition with childhood abuse provides somewhat mixed results in the existing literature on this topic.

IPV and ODD. Research on children’s exposure to IPV and childhood externalizing behaviors has grown significantly over the past 40 years, with the first empirical study emerging in the early 1980s (Wolfe et al., 2003). Despite the methodological issues discussed in the previous section regarding research on IPV (e.g., lack of clarity in defining what constitutes exposure to IPV and overreliance of self-reporting from parents), it is clear from the available research that IPV has significant and measurable adverse effects in a wide range of important domains of child development such as general health, school achievement, and emotional and behavioral functioning (Wolfe, Crooks, Lee, McIntyre-Smith, & Jaffe, 2003). Specifically related to the development of externalizing problems, there are many studies that indicate a positive association between IPV exposure and children’s externalizing problems (Kitzmann, Gaylord, Holt, & Kenny, 2003; Wolfe et al., 2003).

Wolfe and colleagues (2003) used 41 empirical studies for meta-analysis to examine the effects of domestic violence on children's developmental outcomes, including externalizing behaviors, and found that children who were exposed to IPV had more behavioral problems than children who were not exposed to IPV (Wolfe et al., 2003). Similar to this meta-analysis, Kitzman and colleagues (2003) also used a meta-analysis of 118 studies and examined psychosocial outcomes, including externalizing problems such as aggression and oppositional behaviors, in children exposed to IPV (Kitzmann et al., 2003). The research resonated with the previous finding of a positive association between aggressive and oppositional behaviors in children with exposure to IPV (Kitzmann et al., 2003). In addition, they did not find a significant difference between children exposed to physical abuse and children exposed to IPV in terms of externalizing behavior. However, IPV in the analysis was limited to witnessing physical violence in homes, and the researchers suggested if the broader range of definitions of IPV were included (e.g., verbal or emotional violence between parents), the result may differ.

Finally, in a more recent systematic review conducted by Rhoades (2008), she concludes that exposure to a parental conflict was associated with behavioral problems such as aggression in children. She explains that conflict affects children through decreasing their sense of emotional security and increasing stress. Similar to previous studies and reviews, she concluded that IPV contributes to an increased risk of developing externalizing problems in children (Rhoades, 2008).

To summarize the empirical findings of research evaluating the impact of IPV exposure on children's well being, exposure to IPV seems to put children at higher risk for developing externalizing problems consistent with ODD symptoms compared to children from nonviolent homes.

Family Environmental Factors associated with ODD and ADHD Comorbidity

This section will review four-family factors (e.g., maternal sensitivity, maternal harshness, corporal punishment, and intimate partner violence) that are associated with the children who have both ADHD and ODD. In general, a limited number of studies are available in each section, as only a handful of studies target these two comorbid disorders in early childhood examining the four-family factors mentioned above.

Maternal Sensitivity and Comorbidity. Regarding maternal sensitivity and its association with children who have both ADHD and ODD, Kaiser and his colleagues examined how the severity of ADHD and maternal sensitivity can explain variability in a child's inattention, hyperactivity, and aggressive behaviors (Kaiser, McBurnett, & Pfiffner, 2011). The study reported a moderating role of maternal sensitivity as a protective factor

between ADHD symptoms and a child's behavioral problems, even after controlling for the severity of ADHD (Kaiser et al., 2011). Specifically, a higher level of positive maternal parenting was associated with lower child aggression and oppositional behavior (Kaiser et al., 2011). This study supported the role of maternal sensitivity as a protective factor in the co-occurring development of ADHD symptoms and behavioral problems in children (Kaiser et al., 2011).

On the other hand, low maternal sensitivity as a risk factor for the development of comorbid ADHD and ODD in children was not supported. Pfiffner, McBurnett, Rathus, and Judice (2005) examined the differential impact of maternal sensitivity among children with ADHD comorbid with ODD versus children with ADHD comorbid with CD. 149 children between the ages of five and 11 were referred to an ADHD specialty clinic, and parents completed self-report measures related to parenting practices (Pfiffner et al., 2005). One of the key findings in this study was that low maternal sensitivity had a significant association with children who had comorbid ADHD and CD, but not with children who had comorbid ADHD and ODD (Pfiffner et al., 2005). Given that low maternal sensitivity was significantly associated with children with ODD (Stormshak et al., 2000) and not with children who had only ADHD (Johnston et al., 2000), the result of this study looking at the comorbid population might be explained by the role of ADHD symptoms. Possible explanation of this may be that inattentiveness in ADHD symptoms potentially helped to overlook the lack of maternal sensitivity in the mother-child relationship and lead to significantly adverse effect.

In summary, similar to the association between maternal sensitivity and children with ADHD, high maternal sensitivity seems to function as a protective factor whereas low maternal sensitivity does not necessarily seem to be a significant risk factor for children with comorbidity. The association between maternal sensitivity and children with ADHD and ODD comorbidity warrants more examination.

Maternal Harshness/Intrusiveness and Comorbidity. Regarding the impact of maternal harshness on children with ADHD and ODD comorbidity, the study conducted by Johnston and Mash (2001) described previously reported mothers of children with ADHD gave negative attention to children's existing overactive and impulsive behaviors by using repeated commands, more verbal reprimand, and corrections compared to mothers of neurotypical children, which in turn exacerbated children's ADHD symptoms. In this same study, the researchers also examined the mothers of children with both ADHD and ODD. They reported an even stronger association between maternal harshness in children having comorbid ADHD and ODD, compared to children with only ADHD

(Johnston and Mash, 2001). In addition, compared to mothers of children with only ADHD, the mothers of children with comorbid ADHD and ODD perceived greater psychological distress and perceived more family disturbance (Johnston and Mash, 2001). This study provides a clear indication that maternal harshness is a risk factor for children with ADHD and ODD comorbidity.

Corporal Punishment and Comorbidity. When considering children with ADHD and co-occurring ODD, some studies cluster symptoms of ADHD, such as hyperactivity and impulsivity together with signs of ODD such as aggression, noncompliance, and oppositional behaviors, as one and describe them as conduct problems or externalizing behaviors (Dodge et al., 2007). However, this cluster usually does not account for the inattentiveness of ADHD and what exactly constitutes as conduct problem or externalizing behavior varies study by study (Gershoff, 2002). Despite the lack of consistency in defining conduct or externalizing problems, it is generally agreed that children with any one of the behaviors typically considered as conduct problems (hyperactivity, oppositional behavior, or aggression) have behaviors difficult to manage and are at higher risk of parents using corporal punishment as a disciplinary method to manage their children's difficult behaviors (Gershoff, 2002).

Given that there is mixed evidence supporting the association between corporal punishment and children with ADHD (Whitmore et al., 2003; Alizadeh et al., 2007) and also between corporal punishment and children with ODD (Gershoff, 2002; Baumrind et al., 2002), the relationship between corporal punishment and children with comorbid ADHD and ODD is uncertain. However, it is reasonable to assume that behavioral management is more difficult for children with the comorbid condition compared to children with just ADHD or ODD. For instance, parents with comorbid ADHD and ODD children experienced a higher level of parenting stress compared to parents with children who only had ADHD (Johnston & Mash, 2001). The higher the parental stress, the more likely these parents have considered an extreme measure of discipline such as corporal punishment (Johnston & Mash, 2001). Therefore, it is reasonable to predict that higher parental stress could lead to more likely use of corporal punishment that will be ultimately associated as a risk factor for children with ADHD and ODD comorbid conditions.

IPV and Comorbidity. Regarding IPV and children with comorbid ADHD and ODD, Becker and McCloskey's (2002) longitudinal study described in the previous section examines not only attention but also conduct disorder in children exposed to family violence. Findings from this study indicate that there was no significant association of adolescent conduct problems to childhood IPV exposure and ADHD diagnosis (Becker & McCloskey, 2002). However, conduct problems measured in this study differ from ODD symptoms and more

closely resemble the DSM diagnosis of conduct disorder symptoms (e.g., stealing, running away, and lying).

Currently, there is no study looking at the impact of IPV on children, specifically with comorbid ADHD and ODD symptoms. However, given that IPV has a clear negative impact on both children with ADHD (Bauer et al., 2013) and ODD (Kitzmann et al., 2003), it is likely that children with comorbid ADHD and ODD will have a significant association with IPV exposure.

Purpose of the Current Study

The present study is designed to address gaps within the current literature on comorbidity between ADHD and ODD in early childhood. In literature it is clear that ADHD is one of the most common childhood disorders (Biderman & Faraone, 2005), ODD co-occurs with ADHD at a greater rate than any other childhood disorders (Angold et al., 1999; Maughan et al., 2004), and that comorbidity between these disorders often emerge in early childhood during preschool years (Johnston & Mash, 2001). Such emergence in early childhood is also relevant given the documented effects of familial environmental factors on social, emotional, and behavioral development during this developmental period (Denham, 2006; Johnston & Jassy, 2007). However, the current literature does not fully address the potential contributions of familial environment factors (e.g., maternal sensitivity, maternal harshness, corporal punishment, and intimate partner violence) on concurrence of ADHD and ODD in early childhood.

Research indicates that children with ADHD symptoms are more likely to develop symptoms of ODD (Costello et al., 2003; Nock et al., 2007) and that this relationship can be moderated by parenting practices as both risk and protective factors (Johnston & Jassy, 2007; Patterson et al., 2000; Johnston & Mash, 2001; Kaiser et al., 2011). Based on the literature review, maternal sensitivity will be both risk factor (e.g., low maternal sensitivity) and protective factor (e.g., high maternal sensitivity) whereas maternal harshness will only be a risk factor (e.g., low maternal sensitivity) for development of ODD in children with ADHD. As there are some evidences of independent and distinct role that maternal sensitivity plays compared to maternal harshness (Johnston and Mash, 2001; Harvey et al., 2016), it is important to consider these two variables separately in terms of their impact on comorbidity.

Similarly, use of corporal punishment can act as a risk factor (Becker et al., 2002), and existence of intimate partner violence between parents can also act as a risk factor (Wolfe et al., 2003) for development of ODD in children with ADHD. While some of the available literature regarding ADHD and ODD comorbidity during early childhood focuses on these familial environmental factors, the information is limited and especially scarce in early childhood without comorbidity of CD as well (Harvey et al., 2016; Riddle et al., 2013). Therefore, the present study will examine the effect of familial environmental factors on the comorbidity of ADHD and ODD in early childhood using two different approaches.

Research Questions and Hypotheses

The first approach is a person or clinical group oriented approach to examine the differences in various familial environmental factors (e.g., maternal sensitivity, maternal harshness, corporal punishment, and intimate partner violence) in the development of ODD for children with or without ADHD. Specifically, children will be divided into four groups (e.g., ADHD only, ODD only, comorbid, and control) based on their clinical level of ADHD and ODD symptoms. This division based on clinical levels will generate useful descriptive information on each group as the groups can be matched with DSM-V criteria and generalized to clinical practices.

The second approach is a process or variable oriented approach to examine the development of ODD as a function of ADHD as moderated by different familial environmental factors (e.g., maternal sensitivity, maternal harshness, corporal punishment, and intimate partner violence). This approach examines interaction of each familial environment variables with ADHD and addresses how they serve as risk and/or protective factors for the development of ODD. The present study will address seven specific research questions:

Using a person-oriented (clinical categorization) approach:

1. What is the degree of co-morbidity between ADHD and ODD in this sample and is it greater than what would be expected by chance? I hypothesize that co-morbidity between ADHD and ODD in the sample will be significantly higher than expected by chance.
2. Are there significant differences in maternal sensitivity among different groups of 1st grade children (e.g., ADHD only, ODD only, Comorbid, and Control)? I hypothesize that maternal sensitivity will be the highest in control group, followed by ADHD only, ODD only, and then comorbid group.

3. Are there significant differences in maternal harshness among different groups of 1st grade children (e.g., ADHD only, ODD only, Comorbid, and Control)?)? I hypothesize that comorbid and ODD only group will have the highest level of maternal harshness, followed by ADHD only group, and then control group.
4. Are there significant differences in corporal punishment among different groups of 1st grade children (e.g., ADHD only, ODD only, Comorbid, and Control)?)? I hypothesize that comorbid group will have significantly higher level of corporal punishment, followed by ODD only group, ADHD only group, then control group.
5. Are there significant differences in intimate partner violence among different groups of 1st grade children (e.g., ADHD only, ODD only, Comorbid, and Control)?)? I hypothesize that children in comorbid, ODD only, and ADHD only group will have significantly higher level of exposure to IPV compared to control group.

Using a variable-oriented approach:

6. Do symptoms of ADHD significantly predict ODD symptoms? I hypothesize that symptoms of ADHD will significantly predict ODD.
7. Does each of familial environmental factors (e.g., maternal sensitivity, maternal harshness, corporal punishment, and intimate partner violence) significantly predict ODD as in main effects above and beyond the effects of ADHD?)? I hypothesize that high levels of maternal harshness, high and severe frequency of corporal punishment, and presence of IPV will be significant predictors of ODD as a function of ADHD whereas high levels of maternal sensitivity will be inversely associated in predicting ODD for children with ADHD. Based on the literature review, low levels of maternal sensitivity will not be significant predictors of ODD as a function of ADHD.
8. Do familial environmental factors (e.g., maternal sensitivity, maternal harshness, corporal punishment, and intimate partner violence) moderate the association between ADHD and ODD?)? I hypothesize that interaction among familial environmental factors will moderate the development of ODD for children with ADHD.

CHAPTER 2: RESEARCH METHODS

Participants

The data for the proposed study will be gathered from the Family Life Project (FLP). The FLP is a large longitudinal study of children and families in rural and low-income counties of Eastern North Carolina and Central Pennsylvania exploring the role of child, family, and contextual factors in child development (Wagner, Mills-Koonce, Willoughby, Zvara, & Cox, 2015). The families and their newborns in the counties above were recruited using a stratified random sampling procedure over a 1-year period (e.g., September 2013 through September 2014) at the time mothers gave birth to child using standardized script and protocols. Families were recruited from hospitals at the birth of the child; in addition, birth records were used to identify potential participants who were born in hospitals outside of the target counties. Using three exclusion criteria (e.g., primary language is not English, resided in counties that were outside of the geographical area of interest, and had plan to move the geographical area of interest within three years), a total 1,292 families were enrolled in the study. Of note, the sample included an oversampling of low-income families and African-American families to ensure sufficient power for longitudinal analyses of all subgroups families. Of the 1,292 families enrolled, over 99% of primary caregivers were biological mothers and approximately 41% were African American. On average, mothers were 28 years old when the child included in this study was born, over half of them were married and employed, and had average education for mothers were 13 in years (e.g., about 16 % had 4-year-college degree). Lastly, the mean income-to-needs ratio for the household was 1.9 (a 1.0 ratio that indicates federal poverty threshold).

Design of the current study is a passive longitudinal study with specific time points as listed below: Measure of maternal parenting behaviors (e.g., sensitivity and harshness) at 24, 36, and 58 months, measure of IPV at 24, 36, and 57 months, measure of corporal punishment at 36 and 58 months, and measure of symptoms ratings for both ADHD and Conduct Problem (e.g., ODD symptoms) at first grade.

Procedure

Home visits occurred with two research assistants when the children were approximately 2, 6, 15, 24, 36, 48, and 60, months of age and when the child was in the first grade (Rehder, Mills-Koonce, Willoughby, Garrett-

Peters, & Wagner, 2017). At the initial visit, when child was 2 months of age, one research assistant used a laptop and entered information from the mother on key variables including demographics of household members and employment status of caregivers. When children were 6, 15, 24, 36, 48, 60 months of age, and again when the child was admitted in the first grade, two research assistants visit the family and administered interviews with mothers and administered questionnaires regarding child's behavior, and conducted child assessments, videotaped interactions between mother and child (e.g., measure of maternal parenting behaviors).

At 24 and 36-month visits, the interaction between mother and child was observed through a 10-minute task, which consisted of three consecutive peg puzzles of increasing difficulties (Rehder et al., 2017). The observation lasted approximately 10 minutes. At 58 month visit, the interaction between mother and child consisted of a card game and a tower building task. For the card game, mother and child competed to collect the most card in a "slap-jack" game. For the tower building task, child was instructed to replicate the sample block built by the RA using different sizes and shapes of blocks. The observation lasted approximately 15 minutes. For all the tasks at 24, 36, and 58 month visits, mothers were instructed that the tasks (e.g., puzzle and tower building) were for the child to complete but should provide assistance as needed.

Measures

Attention deficit/hyperactivity disorder (ADHD) symptom rating. Using a four-point Likert scale (0 being not at all, 1 being just a little, 2 being pretty much, and 3 being very much), 18 ADHD symptoms listed in DSM-IV were rated by mothers when the child was in the first grade (Willoughby, Williams, Mills-Koonce, & Blair, 2019). Items rated above 2 were considered as a positive endorsement for a clinical level of symptom, following previous studies using similar measure (e.g., Pelham, Gnagy, Greenslad, & Milich, 1992). As outlined in DSM, an elevated risk for ADHD was defined as six or more of inattentive and/or hyperactive-impulsive symptoms at each assessment.

Conduct Problem. To measure levels of conduct problems, mothers rated the Disruptive Behavior Disorder Rating Scale (DBDRS) when the child was at first grade (Willoughby et al., 2019). The DBDRS (Pelham, Gnagy, Greenslade, & Milich, 1992) is a well-established and valid rating scale that includes subscales for oppositional defiance (ODD), conduct disorder (CD), hyperactive-impulsivity, and inattention reflecting DSM-IV criteria. Specifically, ODD items will be used for the current study, which includes characters such as defiance, anger, and argumentativeness.

Maternal Parenting Behaviors. To measure maternal parenting behaviors, mother-child interactions during a free-play with toys and card games at 24, 36, and 58 months were videotaped and coded (Cox, Paley, Burchinal, & Payne, 1999; NICHD Early Child Care Research Network, 1999). In addition, a set of three puzzles with increasing difficulty at 24 and 36 months and a tower building task at 58 month were provided to complete for the child. Mothers were instructed to provide assistance as they felt necessary. The research assistants (e.g., a team of four to five coders with one or two master coder) were trained and coded a rating on various maternal parenting behavior constructs on seven-point Likert scale (1 being not at all characteristic to 7 being highly characteristic). The coders were unaware of the study's hypotheses. Each coder completed approximately 30% of the assigned videotapes with the master coder(s) and the reliability was calculated using the correlation of overlapping coding assignments among the teams. Reliability was high (e.g., interclass correlations for sensitivity were all above .80 across three different time points for all constructs).

Two constructs (e.g., maternal sensitivity and maternal harshness/intrusiveness) will be used for the analysis of current study. As parenting behaviors are consistent and stable across early childhood (Behrens, Hart, & Parker, 2012) and three time points were highly correlated, latent maternal sensitivity and maternal harshness/intrusiveness composite scores were created to capture the cumulative effect of maternal sensitivity and maternal harshness/intrusiveness constructs. Maternal sensitivity will be computed as a mean of sensitivity at three different time points (e.g., 24, 36, and 58 months) using the sum of subscales scores for sensitivity, positive regard, stimulation of development, animation, and reverse score of detachment/disengagement. On the other hand, maternal harshness or intrusiveness will be computed as a mean of harshness/ intrusive at three points (e.g., 24, 36, and 58 months) using the sum of subscale scores for intrusiveness and negative regard for the child.

Corporal Punishment. To measure the use of corporal punishment, a modified version of parent-child conflict tactics scale (CTSPC; Straus, 1997) was used. At 36- and 60- months, mothers completed this modified version of 20-item questionnaire. Only the four items related to physical aggression subscale ($\alpha = .52$ at the 36-month and $\alpha = .50$ at the 60-month assessments) will be used for the current study. In the questionnaire, mothers reported how often they exhibited specific behaviors in past during conflict with their child through six-point Likert scale (0 being never and 6 being almost every day). An example of subscale items includes: "how often have you hit or tried to hit the child with something?"

Intimate Partner Violence. To measure the presence of intimate partner violence (IPV), the Conflict Tactics Scale-Couple Form R (CTS-R; Straus and Gelles, 1990) was used. At 36- and 60- months, mothers completed this 19-item questionnaire that asked them to rate how often in the past 12 months their partner engaged in particular behaviors to manage conflict in the romantic relationship. The questionnaire had a six-point Likert scale (0 being never and 6 being more than 20) and the nine items from this questionnaire related the Physical Violence subscale (which is calculated by taking the mean of these items; $\alpha = .67$ at the 36- month and $\alpha = .75$ at the 60- month assessments) will be used in this study. An example of subscale items includes: “how often has your partner kicked, bit, or hit you with a fist?”

Covariates. In order to account for any confounding or interacting variables, some demographic variables measured at each visit will be considered in the analysis. Mothers’ report of their highest level of completed education (in years), the marital status (0 being unmarried and 1 being married), the child’s race (0 being white and 1 being black), and child’s sex (0 being female and 1 being male) will be accounted in the current analysis. In addition, income-to-needs ratios will be used as a covariate for all variables in this study which will be computed by dividing the total household income from all possible sources with the federally determined poverty threshold for the number of individuals living in the house for that year (e.g., ratio above 1.0 being able to provide basic needs for the family, below 1.0 being not able to provide basic needs for the family). Lastly, the sites where data was collected (e.g., North Carolina and Pennsylvania) will be used as a covariate as well to account for variability in task administration across two sites.

Table 1

Description and psychometric properties of measures used

Variables of Interest	Name of Measure	Description of Measure	Psychometric Properties
Outcome measure; Symptoms of Attention Deficit Hyperactivity Disorder	ADHD Symptom Rating Scale (De Paul et al., 1998)	A DSM-IV guided rating scale that consists of four-point scale; scores of two or three in six items of inattention and six items of hyperactivity domains were considered positive clinical endorsement	Reliability; $\alpha = 0.87$ for inattention and $\alpha = 0.85$ for hyperactivity (See Willoughby, Pek, and Grenberg, 2013) Validity; established in Pelham, Gnagy, Greenslade, & Milich, 1992

		of ADHD symptoms for this study. (Measured time point; 1 st grade)	
Outcome measure; Symptoms of Oppositional Defiant Disorder	Disruptive Behavior Disorder Rating Scale (DBDRS; Pelletier, Collet, Gimpel, & Crowley, 2006)	A DSM-IV guided rating scale that includes subscales for assessing ODD symptoms (e.g., defiance, argumentativeness, and anger). A four-point scale, scores of two or three in two domains of ODD were considered positive clinical endorsement of ODD symptoms for this study. (Measured time point; 1 st grade)	Reliability; $\alpha = 0.95$; (See Wright, Waschbusch, & Frankland, 2007) Validity; established in Pelletier et al., 2006
Family Factor; Maternal Sensitivity	Recorded observation of mother-child interactions consisting of free-play with toys, puzzle, card game, and tower building tasks.	Mean of sensitivity across three time points (subscales scores in sensitivity, positive regard, stimulation of development, animation, and reverse score of detachment/disengagement) in seven-point likert scale using trained coders; Measured time points; 24, 36, and 58 months	Reliability among coders and master coder; α -level above 0.80 across all three time points See validity establishment in Cox, Paley, Burchinal & Payne, 1999
Family Factor; Maternal Harshness/ Intrusiveness	Recorded observation of mother-child interactions consisting of free-play with toys, puzzle, card game, and tower building tasks.	Mean of harshness/intrusiveness across three time points (subscale scores in intrusiveness and negative regard) in seven-point likert scale using trained coders; Measured time points; 24, 36, and 58 months	Reliability among coders and master coder; α -level above 0.80 across all three time points See validity establishment in Cox, Paley, Burchinal & Payne, 1999
Family Factor; Corporal Punishment	A Parent-Child Conflict	A 20-item questionnaire reporting parent	Reliability; $\alpha = 0.52$ at 36 month 0.50 at 58 month (See Gustafsson, Barnett, Towe-Goodman, Mills-Koonce, and Cox, 2015)

	Tactics Scale (CTSPC; Straus, 1979)	behavior in response to conflict with their child; The current study only used the four items from physical aggression subscale. (Measured time points; 36 and 58 months)	Validity; established in Straus, 1979
Family Factor; Intimate Partner Violence	Conflict Tactics Scale- Couple Form R (CTS-R; Straus & Gelles, 1990)	A 19 item self-report measure of responses to conflict in romantic relationship; The current study only used the nine items from physical violence scale. (Measured time points; 36 and 58 months)	Reliability; $\alpha = 0.89$ at 36 month 0.95 at 58 month (See Gustafsson and Cox, 2016) Validity; established in Straus and Gelles, 1986

Ethical Consideration

The study will be conducted contingent on the approval of the Institutional Review Board (IRB) at the University of North Carolina at Chapel Hill. The proposal will meet all the guidelines and criteria for secondary data analysis before being analyzed.

Data Analysis Approach

Quantitative data will be examined and analyzed using the statistical program SPSS for Mac. To answer proposed research questions, two statistical analysis will be used: First, One-way ANCOVA will be conducted to obtain descriptive statistics and compare group mean differences among four groups (e.g., ADHD only, ODD only, ADHD and ODD comorbid, and control group) on family variables of interest (e.g., maternal sensitivity, maternal harshness/intrusiveness, use of corporal punishment, and presence of intimate partner violence). If significant differences are found in the groups, a post-hoc statistic such as Tukey's HSD will be used to further assess the group differences.

Second, regression analyses will be conducted to examine the association between ADHD symptoms and ODD symptoms, the association between familial factors and ODD symptoms (above and beyond the effects of ADHD), and the degree to which familial factors moderate the association between ADHD and ODD symptoms. The first step in these set analyses will be to conduct regression analyses including all control variables and ADHD

symptoms as a main effect predictor of ODD. Next, I will conduct separate regression analyses for each of the four family factors (serving as main effects and moderators of ADHD). For example, the regression model including maternal sensitivity would include all control variables, ADHD, maternal sensitivity, and the interaction term for ADHD*maternal sensitivity. If the interaction is insignificant then this term will be dropped and main effects will be examined without the interaction term. In order to probe for interaction effects, I will compare simple slopes for the association between ADHD and ODD based on different levels of the moderators (parenting, punishment, and IPV) following procedures outlined by Preacher, Curran, and Bauer (2006).

CHAPTER 4: RESULTS

This study examined the effect of four family variables (e.g., maternal sensitivity, maternal harshness, use of corporal punishment, and presence of IPV) on the comorbidity of ADHD and ODD in early childhood using two different conceptual approaches. The first approach used clinical categorization or person oriented approach to describe the role of different family factors in the development of comorbidity in early childhood whereas the second approach focused on the variables itself to describe the comorbidity. First, descriptive information and distribution of key variables will be briefly described and eight questions and hypotheses generated from the two approaches described above will be discussed. Examination of the questions was based on the secondary data analysis using the Family Life Project described in earlier section.

Descriptive Statistics.

Table 2 presents correlations, means and standard deviations for the model covariates and variables of interest. Total 878 participants with full data at each time point were used for analysis. Approximately 56.6 percent of sample was collected from NC, 50.8 percent were girls, 37.7 percent were African American, and 44.3 percent of mothers reported single status. Each of the outcome variables (e.g., ADHD and ODD), which were measured in first grade, were significantly correlated with each time point of maternal sensitivity (24, 36, and 58 months), maternal harshness (24, 36, and 58 months), use of corporal punishment (36 and 60 months), and presence of IPV (36 and 60 months). Exceptions include the correlation between child sex and other control variables. The positive correlation between first grade ADHD and family variables (e.g., maternal negativity, corporal punishment, and IPV) were stronger than the correlation between first grade ODD and the same family variables. Similarly, the negative correlation between first grade ADHD and maternal sensitivity was stronger than the negative correlation between first grade ODD and maternal sensitivity.

Table 2

Correlation, means and standard deviations (or percentages) for variables¹

	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>	<u>12</u>
1. State ²	-											
2. M. Ed.	.17	-										
3. Ch. Sex ³	.07	.00	-									
4. Ch. Race ⁴	-.63	-.22	.02	-								
5. Partner ⁵	.17	.45	-.00	-.35	-							
6. Income	.27	.59	.04	-.37	.44	-						
7. M. Sens	.25	.50	-.03	-.40	.42	.47	-					
8. M. Neg	-.29	.39	.11	.39	-.33	-.35	-.56	-				
9. Cor. Pun.	-.19	-.08	.08	.27	-.13	-.12	-.19	.19	-			
10. IPV	-.09	-.21	.01	.22	-.15	-.19	-.25	.23	.23	-		
11. ADHD	-.05	-.30	.11	.15	-.26	-.25	-.32	.28	.15	.21	-	
12. ODD	.13	-.09	.03	-.07	-.07	-.10	-.11	.10	.13	.18	.42	-
Mean		14.72				1.88	2.94	2.30	0.18	0.13	0.84	0.41
(SD)		(2.74)				(1.39)	(0.69)	(0.73)	(0.56)	(0.34)	(0.42)	(0.48)
%	56.6%		50.8%	37.7%	44.3%							
	NC		girls	black	single							

Notes: ¹ All correlations above $r = .065$ are statistically significant. ² 0 = NC, 1 = PA. ³ 0 = girls, 1 = boys. ⁴ 0 = white, 1 = black. ⁵ 0 = single, 1 = partnered

Figure 1 below presents the distributions of ADHD and ODD symptoms. With skewness less than 0.5 and kurtosis close to 0, the distribution of ADHD symptoms can be assumed symmetric and close to normal distribution. On the other hand, skewness over 1 and high kurtosis close to 5, the distribution of ODD symptoms is considered to be positively skewed and possibly with some outliers.

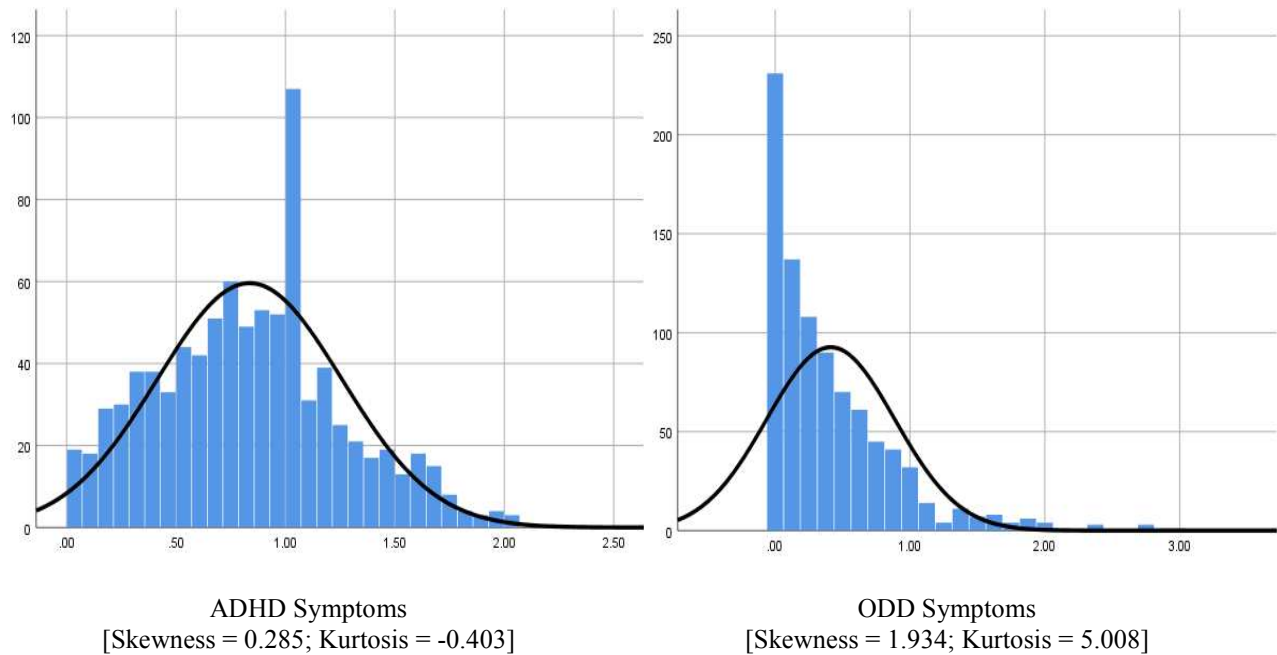


Figure 1. Distributions of ADHD and ODD Symptoms

Figure 2 below presents the distributions of family environmental variables. Although slightly skewed for maternal negativity, overall both maternal sensitivity and maternal negativity assumed normal distribution without significant outliers. On the other hand, both corporal punishment and IPV were strongly positive skewed possibly with extreme outliers.

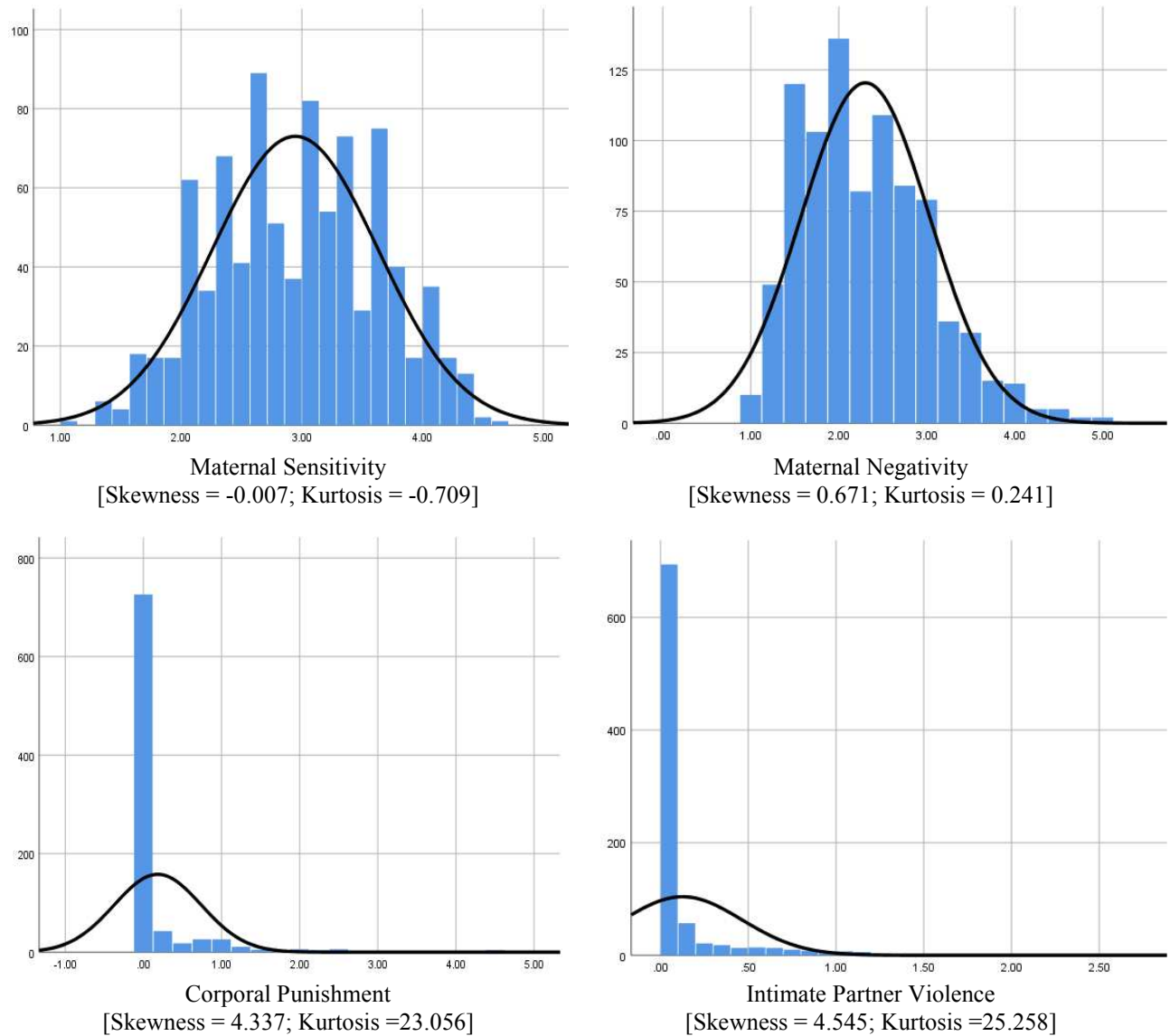


Figure 2. Distributions of Family Environmental Variables

Person-oriented Hypotheses

Five questions and hypotheses were examined using person-oriented approach. Each hypothesis will be examined and discussed in order.

Research Question 1. Research question 1 asked about the degree of comorbidity between ADHD and ODD in this sample and whether it would be greater than what would be expected by chance. It was hypothesized that comorbidity between ADHD and ODD in the sample will be significantly higher than expected by chance based on previous literature. Table 3 is a chi-square analysis of sample, including children with ADHD and ODD comorbidity. With p -value less than .05, the null hypothesis is rejected based on evidence that ADHD and ODD co-

occur at levels greater than expected by chance ($X^2 = 37.648, p < .001$). The 14 cases represent an increase of 411.8 percent more children with ADHD and ODD comorbidity than would be expected by chance.

Table 3

Chi-Square Analysis of co-occurring ADHD and ODD

	No ODD	ODD	Total
No ADHD	778 (767.4 exp.)	27 (37.6 exp.)	805
ADHD	59 (69.6 exp.)	14 (3.4 exp.)	73
Total	837	41	878

Research Question 2. Question 2 asked whether there were significant differences in maternal sensitivity among groups of 1st grade children. Based on the literature review, it was hypothesized that maternal sensitivity will be significantly higher in control (e.g., no ADHD/ODD) group compared to ADHD only and ODD only group followed by comorbid (e.g., ADHD/ODD) group. After controlling for covariates such as state, maternal education, child sex, child race, in-home partner, and family income, ANCOVA was used and determined that ADHD/ODD group membership significantly predicted maternal sensitivity in the early years of life ($p = .006$). Specifically, follow up post-hoc test determined that children in control group experienced significantly higher maternal sensitivity than children with ADHD only and children in comorbid group. Please see Table 4, Table 5, and Figure 3 below.

Research Question 3. Question 3 asked whether there were significant differences in maternal negativity among groups of 1st grade children. Based on the literature review, it was hypothesized that maternal harshness will be significantly higher in comorbid and ODD only group, followed by ADHD only group, and then control group. After controlling for covariates, ANCOVA was used and determined that ADHD/ODD group membership significantly predicted maternal harshness in the early years of life ($p = .001$). Follow up post-hoc test determined that children in comorbid group experienced significantly greater maternal negativity than children in each of the other three groups. On the other hand, children in control group experienced significantly lower maternal negativity than children with ADHD only group. Please see Table 4, Table 5, and Figure 3 below.

Research Question 4. Question 4 asked whether there were significant differences in corporal punishment among groups of 1st grade children. Based on the literature review, it was hypothesized that corporal punishment will be significantly higher in comorbid group followed by ODD only group, and ADHD only group, the control group. After controlling for covariates, ANCOVA was used and determined that ADHD/ODD group membership

significantly predicted corporal punishment in the early years of life ($p = .001$). Follow up post-hoc test determined that children in ODD only group experienced significantly more corporal punishment than children in ADHD only and control group. Please see Table 4, Table 5, and Figure 3 below.

Research Question 5. Question 5 asked whether there were significant differences in intimate partner violence among groups of 1st grade children. Based on the literature review, it was hypothesized that IPV will be significantly higher in comorbid and ODD only group, followed by ADHD only group, and then control group. After controlling for covariates, ANCOVA was used and determined that ADHD/ODD group membership significantly predicted IPV in the early years of life ($p = .003$). Follow up post-hoc test determined that children in control group experienced significantly lower IPV than children in the other three groups as well as children in comorbid group experienced significantly higher IPV compared to children in the ADHD only group. Please see Table 4, Table 5, and Figure 3 below.

Table 4

ANCOVA Table for differences in early exposures by ADHD/ODD groups

	Maternal Sensitivity		Maternal Negativity		Corporal Punishment		IPV	
	<i>F</i>	<i>p</i>	<i>F</i>	<i>p</i>	<i>F</i>	<i>p</i>	<i>F</i>	<i>p</i>
State	0.01	.93	5.53	.019	1.78	.183	2.42	.120
Maternal education	70.41	.001	37.86	.001	0.14	.711	11.41	.001
Child sex	1.16	.282	14.58	.001	5.670	.017	0.06	.811
Child race	41.50	.001	28.47	.001	22.47	.001	27.49	.001
In-home partner	17.15	.001	7.69	.006	0.27	.601	0.22	.637
Family income	14.56	.001	1.55	.199	0.19	.663	0.36	.550
ADHD/ODD group	4.26	.006	7.55	.001	6.40	.001	4.83	.003

Table 5

Mean differences in early exposures as a function of ADHD and ODD groups

	No DHD/ODD	ADHD-Only	ODD-only	ADHD/ODD		
Maternal Sensitivity	2.971 ^{ab}	2.754 ^a	2.825	2.695 ^b	^a $p=.004$ ^b $p=.063$	d= .39 d= .49
Maternal Negativity	2.275 ^{ab}	2.430 ^{ac}	2.344 ^d	3.050 ^{bcd}	^a $p=.068$ ^b $p=.001$ ^c $p=.001$ ^d $p=.001$	d= .25 d= 1.25 d= .99 d= 1.13
Corporal Punishment	0.163 ^a	0.195 ^b	0.600 ^{ab}	0.375	^a $p=.001$ ^b $p=.001$	d= .82 d= .75
IPV	0.110 ^{abc}	0.183 ^{ad}	0.230 ^b	0.368 ^{cd}	^a $p=.092$ ^b $p=.056$ ^c $p=.003$ ^d $p=.050$	d= .23 d= .38 d= .83 d= .58

Note: Superscript designates group mean comparisons that are statistically significant.

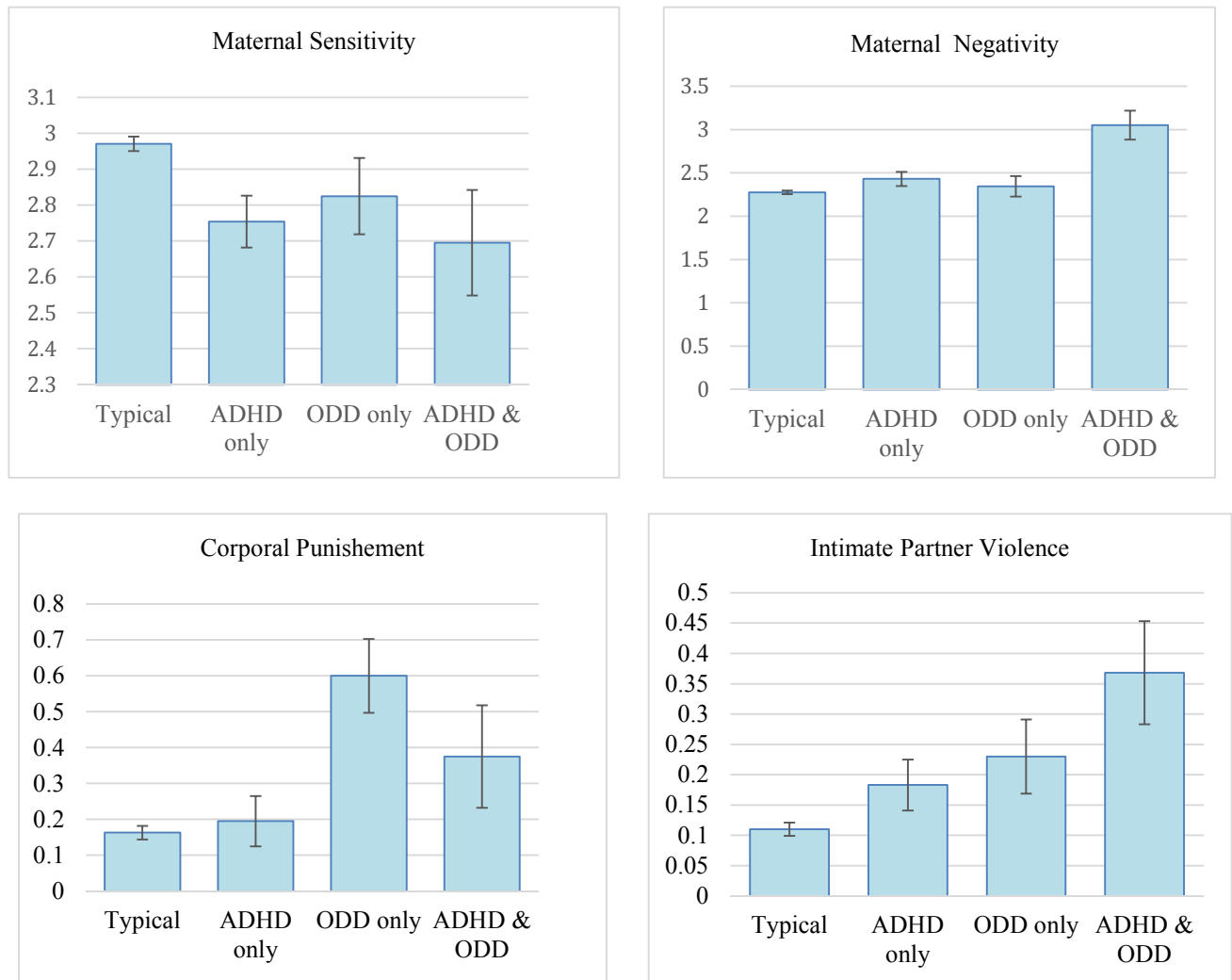


Figure 3. Mean differences in early experience as a function of ADHD/ODD groups

Variable-oriented Hypotheses

Three questions and hypotheses were examined using variable-oriented approach. Each hypothesis will be examined and discussed in order. Although multiple regression analysis was originally planned, the co-linearity between maternal sensitivity and maternal harshness were too high to yield meaningful outcome. Therefore, two models were run each using maternal sensitivity and maternal harshness separately. After controlling for covariates (e.g., state, maternal education, child sex, child race, in-home partner, and family income), ADHD symptoms, family factors, and the interactions between ADHD and the family factors were examined using hierarchical regression analyses.

Research Question 6. Question 6 asked whether symptoms of ADHD significantly contributed to the development of ODD. It was hypothesized that symptoms of ADHD will significantly correlate with the development of ODD symptoms. With $\beta = 0.431$ in a regression model, the null hypothesis is rejected and the result of analysis indicated clear association between ADHD symptoms and development of ODD symptoms in children. Please see table 6 below.

Research Question 7. Question 7 asked whether each family factor had significant main effects in predicting ODD above and beyond the effects of ADHD. It was hypothesized that there will be significant main effects for all four family factors. Please see table 6 for the model with maternal sensitivity and table 7 for the model with maternal harshness. As explained above, two models with one model examining maternal sensitivity, corporal punishment, and IPV was run and the second model examining maternal harshness, corporal punishment, and IPV was run separately due to high co-linearity between maternal harshness and maternal sensitivity. With the first hierarchical regression analysis using maternal sensitivity, the result indicated main effects for corporal punishment and IPV, but absence of main effect for maternal sensitivity to predict ODD symptoms. Specifically, higher exposure to corporal punishment and IPV were associated with higher levels of later ODD symptoms. The second hierarchical regression analysis using maternal negativity similarly found main effects of corporal punishment and IPV, but absence of main effect for maternal negativity to predict ODD symptoms. Consistent with a first regression model using maternal sensitivity, the interaction effects were found and will be discussed in the next question.

Table 6

Hierarchical regression predicting ODD symptoms (without negativity)

	Model 1	Model 2	Model 3	Model 4	Final Model
State	.134**	.104**	.101*	.102**	.100*
M ed	-.036	.049	.064	.057	.058
Child sex	.024	-.021	-.026	-.029	-.026
Child race	-.057	-.089*	-.136**	-.131**	-.130**
Partner	-.048	.006	.010	.013	.010
Income	-.115**	-.082*	-.075 ⁺	-.076 ⁺	-.076 ⁺
ADHD	-	.431***	.403***	.732***	.766***
M. Sens	-	-	-.021	.136 ⁺	.146*
Cor. Pun.	-	-	.090**	-.054	.085**
IPV	-	-	.107***	.091	.095**
ADHD x Sens	-	-	-	-.334	-.356**
ADHD x C.P.	-	-	-	.148	-
ADHD x IPV	-	-	-	-.001	-
<i>Adj R</i> ²	.033	.195	.214	.220	.220
ΔR^2		.162***	.021***	.009*	

Notes: Standardized Betas are reported.

Table 7

Hierarchical regression predicting ODD symptoms (without sensitivity)

	Model 1	Model 2	Model 3	Model 4	Final Model
State	.134**	.104**	.104**	.100*	.098*
M ed	-.036	.049	.065	.055	.056
Child sex	.024	-.021	-.029	-.029	-.028
Child race	-.057	-.089*	-.138**	-.130**	-.131**
Partner	-.048	.006	.010	.011	.011
Income	-.115**	-.082*	-.076 ⁺	-.078*	-.077 ⁺
ADHD	-	.431***	.402***	.137	.120
M. Neg	-	-	.032	-.140 ⁺	-.158*
Cor. Pun.	-	-	.090**	-.031	.085**
IPV	-	-	.106***	.093	.094**
ADHD x Neg	-	-	-	-.352*	-.389**
ADHD x C.P.	-	-	-	.124	-
ADHD x IPV	-	-	-	-.001	-
<i>Adj R</i> ²	.033	.195	.215	.220	.221
ΔR^2		.162***	.022***	.008*	

Notes: Standardized Betas are reported.

Research Question 8. Question 8 asked whether family environmental factors moderated the association between ADHD and ODD in terms of interaction effect. It was hypothesized that interaction among family factors will moderate the development of ODD for children with ADHD. As briefly indicated in the previous question, interaction effect for maternal sensitivity and maternal harshness were examined. To probe the interaction, the simple slopes and the regions of significance for the association between ADHD and ODD symptoms and one standard deviation below the mean of sensitivity, at the mean of sensitivity, and at one standard deviation above the

mean of sensitivity were examined. Although the association between ADHD and ODD symptoms were not significant at mean levels and at one standard deviation above, the association was significant at one standard deviation below the mean of maternal sensitivity ($p < .05$). Region of significance analyses indicated that only when maternal sensitivity was rated as 2.45 or lower which is slightly greater than 0.7 standard deviations from the average level of maternal sensitivity, the association between ADHD and ODD symptoms is significant. Please see figure 4 for further detail.

However, using a similar approach to probe the interaction for ADHD symptom and maternal negativity failed to determine the significant simple slopes or regions of significance with maternal negativity as a moderator. To address this, association between maternal harshness and child ODD symptoms were probed with the ADHD symptom as a moderator. As a result, maternal harshness was positively associated with ODD symptoms ($b = .072$, $p = .036$) at high levels of ADHD symptoms. However, at low or average levels of ADHD symptoms, no association between maternal harshness and ODD symptoms were found. Please see figure 5.

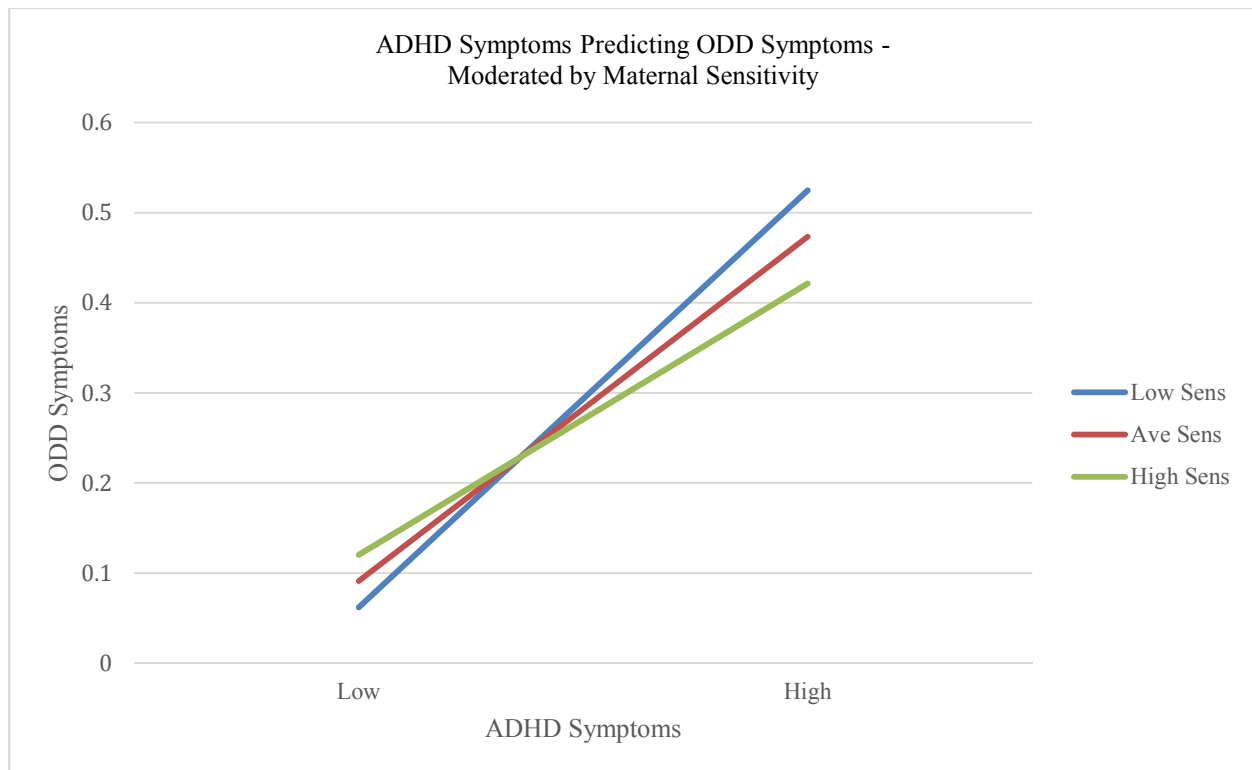


Figure 4. Interaction plot with Maternal Sensitivity

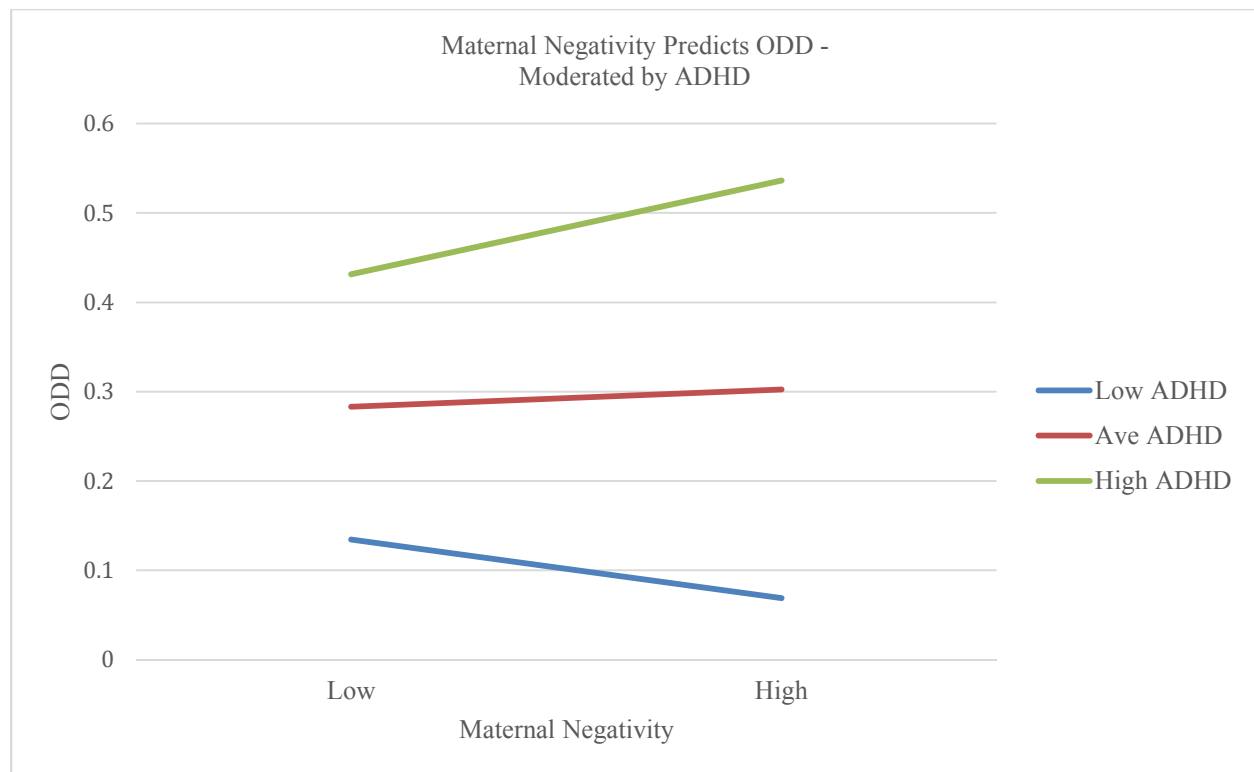


Figure 5. Interaction plot with Maternal Negativity

CHAPTER 4: DISCUSSION

It is clear from the literature that the co-occurrence of ADHD and ODD is high and that early childhood is a critical period for the emergence of this concurrence (Johnston and Mash, 2001; Harvey et al., 2006). However, the importance of family environmental factors on comorbidity in early childhood is not sufficiently addressed in the literature. This current study aimed to describe the role of various family environmental factors in a child's early life. The study focuses on the comorbidity of ADHD and ODD using two conceptual approaches (e.g., person-oriented and variable-oriented) in the context of developmental precursor model (e.g., protective and risk factors). Overall, the current study provides additional support for the link between family environmental variables and the development of ODD for children with and without ADHD. It also makes contributions to our understanding of how each variable uniquely contribute to emerging ODD symptoms with different levels of ADHD symptoms.

Person-oriented Hypotheses

A person-oriented approach was used to examine the role of family environmental factors on the concurrence of ADHD and ODD in early childhood using five questions (e.g., questions 1 through 5) discussed in the previous section. As expected from the well-established co-occurrence of two disorders in the past literature (Nock et al., 2007; Waschbusch, 2002), the first question verified the degree of comorbidity between two disorders was significantly higher than would be expected by chance. The next four questions focused on describing the difference between four groups categorized by children's clinical level of ADHD and ODD symptoms. Although ADHD/ODD group membership significantly predicted children's experience on all four family environmental factors as expected, there were some discrepancies in a specific hypothesis.

First, consistent with the hypothesis, maternal sensitivity was significantly higher in the control group compared to ADHD only or comorbid group. However, a lack of significant difference between the ODD group and the control group was unexpected as the literature provided evidence of a strong association between maternal sensitivity and children with ODD (Deater-Deckard et al., 2006). One possible explanation for this unexpected lack of mean difference between ODD group and control may be due to lack of power in the analysis as the ODD group only had 27 cases compared to 778 cases in the control group.

Second, consistent with the hypothesis, maternal harshness was significantly higher in the comorbid group compared to the rest of the groups. The finding aligned with previous literature that children with comorbid diagnoses experience a significantly higher level of maternal harshness due to increased parental stress experienced from an added number of children's behavioral problems compared to the behavioral problem of a single diagnosis (e.g., children with ADHD only or ODD only) (Stormshak et al., 2000; Johnston and Marsh, 2001). Another important finding from this question was that the control group had significantly lower maternal harshness compared to children with ADHD only group.

Third, consistent with the hypothesis, corporal punishment was significantly higher for children in the ODD only group compared to children in ADHD only and children in the control group. This result provides additional support to the association between ODD symptoms and corporal punishment in literature. It is meaningful to note that without the additive effect of childhood physical abuse, the use of corporal punishment alone was associated with the development of ODD symptoms in children.

In addition, the unexpected result of an insignificant difference between the ODD group and comorbid group may be due to too much variability in the group and too small of a subsample in the comorbid group leading to a lack of power. Although there was a lack of literature examining the association between children with comorbidity and the use of corporal punishment, increased parental stress from managing more than one behavioral problem was associated with more likely use of corporal punishment (Johnston & Mash, 2001). It seems clear from this result that the use of corporal punishment is associated strongly with ODD symptoms uniquely independent of ADHD symptoms. Together, this result highlights potentially two pathways of ODD development in children. In other words, children may develop ODD symptoms with exposure to corporal punishment despite having a low or absence of pre-existing ADHD symptoms, or children may develop ODD symptoms with moderate or high levels of pre-existing ADHD symptoms coupled with low levels of corporal punishment. However, as causality and mechanism underlying association between variables were beyond the scope of this paper, it will be important in future studies to examine further the association between ODD symptoms in children and parental use of corporal punishment.

Lastly, consistent with the hypothesis, IPV was significantly lower for children in the control group compared to the three other groups. In addition, having numerous studies demonstrating a positive association between exposure to IPV and ODD symptoms in children (Wolfe et al., 2003; Kitzmann et al., 2003), it was not

surprising to have the comorbid group significantly higher level of IPV compared to children in ADHD only group. It is clear to see that although children with ADHD were more likely to experience IPV exposure compared to children without any behavioral problem, exposure to IPV was significantly associated with children having ODD symptoms. Although the exact process and mechanism behind this result are beyond the scope of this paper, it may be possible that exposure to parental conflict decreases children's sense of emotional security, which in turn increases children's level of stress (Rhoades, 2008; Kitzmann et al., 2003). Increased stress level is often expressed through behavioral problems such as noncompliance and aggression in children (Rhoades, 2008).

In summary, it seems that parenting styles such as maternal sensitivity and harshness play its role as both protective and risk factors to ODD development only when ADHD symptoms are in the picture. Contrary to parenting styles, exposure to direct (i.e., corporal punishment) and indirect violence in the family (i.e., intimate partner violence) is strongly associated with ODD symptoms in children with or without ADHD symptoms.

Variable-oriented Hypotheses

A variable-oriented approach was used to examine the role of family environmental factors on concurrent ADHD and ODD in early childhood using three questions (e.g., questions 6, 7, and 8) discussed in the previous section. These three questions focused on how each of four family environmental factors, with its interaction with ADHD symptoms, serves as a risk and protective factor for the development of ODD symptoms in children. Overall, the developmental precursor model was supported to explain the moderating role of family environmental factors in the development of ODD symptoms for children with ADHD symptoms.

Specifically, question 6 hypothesized that symptoms of ADHD significantly contributes to the development of ODD, which was supported by examining the beta coefficient value in a regression model. Without any family environmental factors, the co-occurrence of two disorders was high, as expected from the literature (Nock et al., 2007; Waschbusch, 2002). Then question 7 hypothesized the main effect for familial factors above and beyond the impact of ADHD symptoms. As described in the previous section, the main effects were found in only two family variables; IPV and corporal punishment. It was consistent with the literature and findings from questions 4 and 5 above that indicated higher levels of corporal punishment and IPV and higher levels of ODD symptoms in children. It is clear that these two family environmental factors significantly associate with ODD symptoms above and beyond the effects of ADHD and other family factors such as maternal sensitivity and maternal harshness.

Lastly, question 8 hypothesized that there would be an interaction effect on all four family environmental factors. Although there was no interaction effect for IPV and corporal punishment, maternal sensitivity and maternal negativity both had interaction effects that are important to discuss in this section. It was clear that maternal sensitivity was significant between ADHD symptoms and the ODD development at one standard deviation below the mean level of maternal sensitivity. In other words, at the mean level and at one standard deviation above the mean level of maternal sensitivity, maternal sensitivity had a moderating effect as a buffer between ADHD symptoms and the ODD development. This result was consistent with the literature, and documenting the buffering effect of maternal sensitivity in the course of ADHD and ODD comorbidity development has important implications in clinical work. In other words, the buffering effect would imply that educating and training parents to practice sensitive parenting for children with ADHD symptoms would potentially prevent more serious behavioral problems of defiance and disobedience to authority figures later. Also, although maternal harshness did not have a significant role as a moderator between ODD and ADHD symptoms, it held a significant impact on ODD development in the context of children with high levels of ADHD. The finding is consistent with previous findings that maternal harshness is a significant risk factor for ODD development, specifically for children with already high levels of ADHD symptoms. This might be because parents with children who already have high levels of ADHD symptoms are more likely to engage in harsh parenting via a negative feedback cycle (Patterson, 1992). Aversive behaviors from a child's ADHD symptom may elicit more harsh parenting behavior, which in turn reinforces a child's problematic behaviors.

Overall, the current study contributes to the literature by examining how each family's environmental factor uniquely contributes to the development of ODD symptoms for children with varying levels of ADHD symptoms. The current study is noteworthy for examining the role of family environmental factors on the development of comorbidity in children through two different perspectives: person-oriented and variable-oriented. The results discussed in this section imply that two perspectives converge in its findings. Through a person-oriented approach, it was clear to see the differential effects of each family environmental factor on comorbidity development. Through a variable-oriented approach, it was clear how different family environmental factors had those differential effects on comorbidity development. Therefore, the results from each perspective align well with one another and complement each other in a way that facilitates a deeper understanding of the role of family environmental factors on comorbidity.

Strengths and Limitations

Before discussing the limitations of this current study, much strength should be highlighted. First, the sample size of the present study is considerably large, with a total of 878 participants, which increases accuracy and reduces bias, such as sampling error. Second, this study's unique design (e.g., passive longitudinal design) and focus of the age range (e.g., early childhood) are limited in the literature on ADHD and ODD comorbidity. In addition, due to its population-based sample, the findings from this study will be generalizable to rural areas of North America. Fourth, observation of parenting behaviors used in this study is unique as the current study uses observation and ratings from trained research assistants instead of relying on parent self-reports, which are most common in the literature. It also uses qualitative observations of parent-child interaction and records this observation in a quantitative manner that easily allows comparison among participants. Lastly, the current study departmentalizes violence into direct exposure (e.g., corporal punishment) and indirect exposure (e.g., IPV). The departmentalization allows examining the effect of indirect exposure without direct exposure, which is rare in current literature understandably as both types of violence tend to co-occur.

However, there are several limitations to the current study that are important to address. First, although it was beyond the scope of this study, much of the literature on the topic of parent-child relationship agrees on its bi-directional nature (Patterson, 1992). As such, the current study examined how parenting styles and direct and indirect violence at home will impact children. However, the present study does not explore how a child's difficult behaviors had an impact on parenting style or disciplinary actions despite knowing that these difficult behaviors induce higher parental stress and likely cause harsh parenting (Johnston and Jassy, 2007). In the context of the bi-directional nature of the impact on a child's difficult behavior and harsh parenting style, it is difficult to know directionality of cause and effect. However, it is clear that there is a perpetual bi-directional influence on one another through the negative cycle, and it will be important to address this in future studies.

Second, because this study uses a population-based sample from FLP, it tends to generalize in more rural areas and may not be suitable for generalizing in an urban context or same age range children with low risk for behavioral problems and stable family dynamics. Although generalizability is somewhat limited due to this reason, focusing on a high-risk family and children makes a good fit in terms of exploring the nature of the two most significant behavioral disorders in childhood.

Finally, the current study is descriptive in nature, examining the association between family contextual variables and ADHD/ODD comorbidity in young children. As such, this study cannot make any causal inferences among variables. Furthermore, the study does not address the developmental mechanisms underlying the exact process of how risk and protective factors might work. Although associations among variables were described, causality among variables was beyond the scope of this study. Future studies might use findings from this study to build on experimental studies to test for causality and deepen understanding of comorbidity in early childhood. For example, considering the effects of biological markers related to children's ADHD or considering parents' diagnoses (e.g., ADHD or mood disorders) and examining its impact on parenting would be more suitable for an experimental study design that could potentially be built from the current study.

Despite these limitations, the current study offers valuable insight into the early development of comorbidity between ADHD and ODD with regards to important family environmental factors. The findings from this study support the notion that maternal sensitivity and harshness may be critical variables in the development of ODD for children with existing ADHD symptoms.

Conclusion

Overall, findings from this study indicate that each family environmental factor plays an important and unique role in the development of ODD symptoms in children with varying levels of ADHD in early childhood. Critical family environmental factors such as maternal sensitivity provides potential buffering effect for children with high ADHD symptoms. In contrast, maternal harshness may works as a precursor to ODD development for children with high ADHD symptoms. It was also clear that direct and indirect family violence, such as corporal punishment and IPV, were associated as significant risk factors in the development of ODD symptoms in young children regardless of ADHD symptom levels. The current study is one of the few studies with a longitudinal design that focuses explicitly on the ADHD and ODD comorbidity in early childhood. Therefore, findings from the present study provide a meaningful addition of knowledge to current literature on the topic.

This study has several implications for future research. First, the result of this study suggests that it may be possible to identify children who are at risk of developing comorbidity at a very young age based on family environmental variables. For children with high levels of ADHD, maternal harshness is a significant risk factor in the development of ODD. In contrast, maternal sensitivity can be a potential buffer for children with high levels of ADHD in the presence of ODD symptoms. As children often get diagnosed with behavioral disorders when they

enter first grade, it will be important for school and school psychologists to work collaboratively with the family to address risk and protective factors in the family environment in an attempt to reduce comorbidity. Proactively identifying children at risk of comorbidity and working with their family in early childhood maybe especially important as children with comorbidity have significantly poorer prognoses than children with either ADHD or ODD alone (Waschbusch, 2002).

REFERENCES

- Alizadeh, H., Applequist, K. F., & Coolidge, F. L. (2007). Parental self-confidence, parenting styles, and corporal punishment in families of ADHD children in Iran. *Child abuse & neglect*, 31(5), 567-572.
- Angold, A., Costello, E. J., & Erkanli, A. (1999). Comorbidity. *The Journal of Child Psychology and Psychiatry and Allied Disciplines*, 40(1), 57-87.
- American Psychiatric Association. Diagnostic and statistical manual of mental disorders, 5th Edition: DSM-5. 5th. Arlington, VA: American Psychiatric Association; 2013.
- Azeredo, A., Moreira, D., & Barbosa, F. (2018). ADHD, CD, and ODD: Systematic review of genetic and environmental risk factors. *Research in developmental disabilities*, 82, 10-19.
- Bauer, N. S., Gilbert, A. L., Carroll, A. E., & Downs, S. M. (2013). Associations of early exposure to intimate partner violence and parental depression with subsequent mental health outcomes. *JAMA pediatrics*, 167(4), 341-347.
- Baumrind, D., Larzelere, R. E., & Cowan, P. A. (2002). Ordinary physical punishment: is it harmful? Comment on Gershoff (2002).
- Beauchaine TP, Hinshaw SP, Pang KL. Comorbidity of attention-deficit/hyperactivity disorder and early-onset conduct disorder: Biological, environmental, and developmental mechanisms. *Clinical Psychology: Science and Practice*. 2010;17(4):327–336. <http://doi.org/10.1111/j.1468-2850.2010.01224.x>.
- Becker, K. B., & McCloskey, L. A. (2002). Attention and conduct problems in children exposed to family violence. *American journal of orthopsychiatry*, 72(1), 83-91.
- Behrens, K. Y., Hart, S. L., & Parker, A. C. (2012). Maternal sensitivity: Evidence of stability across time, contexts, and measurement instruments. *Infant and Child Development*, 21(4), 348-355.
- Burke, J. D., Rowe, R., & Boylan, K. (2014). Functional outcomes of child and adolescent oppositional defiant disorder symptoms in young adult men. *Journal of child psychology and psychiatry*, 55(3), 264-272.
- Burke JD, Loeber R, Birmaher B. Oppositional defiant disorder and conduct disorder: A review of the past 10 years, part II. *Journal of the American Academy of Child & Adolescent Psychiatry*. 2002;41(11):1275–1293.
- Burt SA, Krueger RF, McGue M, Iacono WG. Sources of covariation among attention-deficit/hyperactivity disorder, oppositional defiant disorder, and conduct disorder: The importance of shared environment. *Journal of Abnormal Psychology*. 2001;110(4):516–525.
- Carpenter, G. L., & Stacks, A. M. (2009). Developmental effects of exposure to intimate partner violence in early childhood: A review of the literature. *Children and Youth Services Review*, 31(8), 831-839.
- Caron, C., & Rutter, M. (1991). Comorbidity in child psychopathology: Concepts, issues and research strategies. *Journal of child Psychology and Psychiatry*, 32(7), 1063-1080.
- Conners, C. K., Sitarenios, G., Parker, J. D., & Epstein, J. N. (1998). The revised Conners' Parent Rating Scale (CPRS-R): factor structure, reliability, and criterion validity. *Journal of abnormal child psychology*, 26(4), 257-268.
- Costello, E. J., Mustillo, S., Erkanli, A., Keeler, G., & Angold, A. (2003). Prevalence and development of psychiatric disorders in childhood and adolescence. *Archives of general psychiatry*, 60(8), 837-844.
- Cox, M. J., Paley, B., Burchinal, M., & Payne, C. C. (1999). Marital perceptions and interactions across the transition to parenthood. *Journal of Marriage and the Family*, 611-625.

- Cunningham, C. E., & Boyle, M. H. (2002). Preschoolers at risk for attention-deficit hyperactivity disorder and oppositional defiant disorder: Family, parenting, and behavioral correlates. *Journal of abnormal child psychology*, 30(6), 555-569.
- Deater-Deckard, K., Ivy, L., & Petrill, S. A. (2006). Maternal warmth moderates the link between physical punishment and child externalizing problems: A parent-offspring behavior genetic analysis. *Parenting: Science and Practice*, 6(1), 59-78.
- Denham SA. Emotional competence: Implications for social functioning. In: Luby J, editor. Handbook of preschool mental health: Development, disorders, and treatment. New York, NY: Guilford Press; 2006. pp. 23–44.
- Dodge, K. A., Coie, J. D., & Lynam, D. (2007). Aggression and antisocial behavior in youth. *Handbook of child psychology*, 3.
- Faraone, S. V., & Biederman, J. (2005). What is the prevalence of adult ADHD? Results of a population screen of 966 adults. *Journal of attention disorders*, 9(2), 384-391.
- Gardner, F. E. (1994). The quality of joint activity between mothers and their children with behaviour problems. *Journal of Child Psychology and Psychiatry*, 35(5), 935-948.
- Gershoff, E. T. (2002). Corporal punishment, physical abuse, and the burden of proof: Reply to Baumrind, Larzelere, and Cowan (2002), Holden (2002), and Parke (2002).
- Gomez, R., & Sanson, A. V. (1994). Mother-child interactions and noncompliance in hyperactive boys with and without conduct problems. *Journal of Child Psychology and Psychiatry*, 35(3), 477-490.
- Goodman, R., & Scott, S. (1999). Comparing the Strengths and Difficulties Questionnaire and the Child Behavior Checklist: is small beautiful?. *Journal of abnormal child psychology*, 27(1), 17-24.
- Greene RW, Biederman J, Zerwas S, Monuteaux MC, Goring JC, Faraone SV. Psychiatric comorbidity, family dysfunction, and social impairment in referred youth with oppositional defiant disorder. *American Journal of Psychiatry*. 2002;159(7):1214–1224.
- Harvey, E. A., Breaux, R. P., & Lugo-Candelas, C. I. (2016). Early development of comorbidity between symptoms of attention-deficit/hyperactivity disorder (ADHD) and oppositional defiant disorder (ODD). *Journal of abnormal psychology*, 125(2), 154.
- Johnston, C., & Jassy, J. S. (2007). Attention-deficit/hyperactivity disorder and oppositional/conduct problems: Links to parent-child interactions. *Journal of the Canadian Academy of Child and Adolescent Psychiatry*, 16(2), 74.
- Johnston, C., & Mash, E. J. (2001). Families of children with attention-deficit/hyperactivity disorder: review and recommendations for future research. *Clinical child and family psychology review*, 4(3), 183-207.
- Kaiser NM, McBurnett K, Pfiffner LJ. Child ADHD severity and positive and negative parenting as predictors of child social functioning: Evaluation of three theoretical models. *Journal of Attention Disorders*. 2011;15(3):193–203. <http://doi.org/10.1177/1087054709356171>.
- Kessler, R. C., & Üstün, T. B. (2004). The world mental health (WMH) survey initiative version of the world health organization (WHO) composite international diagnostic interview (CIDI). *International journal of methods in psychiatric research*, 13(2), 93-121.
- Keown LJ, Woodward LJ. Preschool Boys with Pervasive Hyperactivity: Early Peer Functioning and Mother-Child Relationship Influences. *Social Development*. 2006;15:23–45.

- Kitzmann, K. M., Gaylord, N. K., Holt, A. R., & Kenny, E. D. (2003). Child witnesses to domestic violence: a meta-analytic review. *Journal of consulting and clinical psychology*, 71(2), 339.
- Lahey BB, Van Hulle Ca, Rathouz PJ, Rodgers JL, D'Onofrio BM, Waldman ID. Are oppositional-defiant and hyperactive-inattentive symptoms developmental precursors to conduct problems in late childhood? Genetic and environmental links. *Journal of Abnormal Child Psychology*. 2009;37(1):45–58. <http://doi.org/10.1007/s10802-008-9257-1>.
- Loeber, R., Green, S. M., Lahey, B. B., Frick, P. J., & McBurnett, K. (2000). Findings on disruptive behavior disorders from the first decade of the Developmental Trends Study. *Clinical child and family psychology review*, 3(1), 37-60.
- Moffitt, T. E. (1993). The neuropsychology of conduct disorder. *Development and psychopathology*, 5(1-2), 135-151.
- Maughan B, Rowe R, Messer J, Goodman R, Meltzer H. Conduct disorder and oppositional defiant disorder in a national sample: developmental epidemiology. *J Child Psychol Psychiatry*. 2004;45(3):609–621.
- NICHD Early Child Care Research Network. (1999). Child care and mother-child interaction in the first three years of life. *Developmental Psychology*, 35(6), 1399-1413.
- Nock, M. K., Kazdin, A. E., Hiripi, E., & Kessler, R. C. (2007). Lifetime prevalence, correlates, and persistence of oppositional defiant disorder: results from the National Comorbidity Survey Replication. *Journal of Child Psychology and Psychiatry*, 48(7), 703-713.
- Patterson, G. R., Reid, J. B., & Dishion, T. J. (1992). *Antisocial boys* (Vol. 4). Castalia Pub Co.
- Pelham Jr, W. E., Gnagy, E. M., Greenslade, K. E., & Milich, R. (1992). Teacher ratings of DSM-III-R symptoms for the disruptive behavior disorders. *Journal of the American Academy of Child & Adolescent Psychiatry*, 31(2), 210-218.
- Pettit, G. S., & Bates, J. E. (1989). Family interaction patterns and children's behavior problems from infancy to 4 years. *Developmental psychology*, 25(3), 413.
- Pfiffner, L. J., McBurnett, K., Rathouz, P. J., & Judice, S. (2005). Family correlates of oppositional and conduct disorders in children with attention deficit/hyperactivity disorder. *Journal of abnormal child psychology*, 33(5), 551-563.
- Rehder, P. D., Mills-Koonce, W. R., Willoughby, M. T., Garrett-Peters, P., Wagner, N. J., & Family Life Project Key Investigators. (2017). Emotion recognition deficits among children with conduct problems and callous-unemotional behaviors. *Early Childhood Research Quarterly*, 41, 174-183.
- Rhoades, K. A. (2008). Children's responses to interparental conflict: A meta-analysis of their associations with child adjustment. *Child development*, 79(6), 1942-1956.
- Riddle MA, Yershova K, Lazzaretto D, Paykina N, Yenokyan G, Greenhill L, Posner K. The preschool attention-deficit/hyperactivity disorder treatment study (PATs) 6-year follow-up. *Journal of the American Academy of Child and Adolescent Psychiatry*. 2013;52:264–278. e2. <http://doi.org/10.1016/j.jaac.2012.12.007>.
- Robinson, C. C., Mandleco, B., Olsen, S. F., & Hart, C. H. (2001). The parenting styles and dimensions questionnaire (PSDQ). *Handbook of family measurement techniques*, 3, 319-321.
- Rowe R, Costello EJ, Angold A, Copeland WE, Maughan B. Developmental pathways in oppositional defiant disorder and conduct disorder. *Journal of Abnormal Psychology*. 2010;119:726–738.

- Saunders, B. E. (2003). Understanding children exposed to violence: Toward an integration of overlapping fields. *Journal of interpersonal violence*, 18(4), 356-376.
- Straus, M. A., & Gelles, R. J. (1990). New scoring methods for violence and new norms for the Conflict Tactics Scales. *Physical violence in American families: Risk factors and adaptations to violence in*, 8(145), 341-367.
- Straus, M. A., & Hamby, S. L. (1997). Measuring Physical & Psychological Maltreatment of Children with the Conflict Tactics Scales.
- Stormshak, E. A., Bierman, K. L., McMahon, R. J., & Lengua, L. J. (2000). Parenting practices and child disruptive behavior problems in early elementary school. *Journal of clinical child psychology*, 29(1), 17-29.
- Tandon M, Si X, Luby J. Preschool onset attention-deficit/hyperactivity disorder: course and predictors of stability over 24 months. *Journal of Child and Adolescent Psychopharmacology*. 2011;21(4):321–30. <http://doi.org/10.1089/cap.2010.0045>.
- Tolan, P. H., Dodge, K., & Rutter, M. (2013). Tracking the multiple pathways of parent and family influence on disruptive behavior disorders. In *Disruptive behavior disorders* (pp. 161-191). Springer, New York, NY.
- Tuvblad C, Zheng M, Raine A, Baker LA. A common genetic factor explains the covariation among ADHD ODD and CD symptoms in 9-10 year old boys and girls. *Journal of Abnormal Child Psychology*. 2009;37(2):153–67.<http://doi.org/10.1007/s10802-008-9278-9>.
- Vu, N. L., Jouriles, E. N., McDonald, R., & Rosenfield, D. (2016). Children's exposure to intimate partner violence: A meta-analysis of longitudinal associations with child adjustment problems. *Clinical psychology review*, 46, 25-33.
- Wagner, N. J., Mills-Koonce, W. R., Willoughby, M. T., Zvara, B., & Cox, M. J. (2015). Parenting and children's representations of family predict disruptive and callous-unemotional behaviors. *Developmental psychology*, 51(7), 935.
- Waschbusch DA. A meta-analytic examination of comorbid hyperactive-impulsive-attention problems and conduct problems. *Psychological Bulletin*. 2002;128(1):118–150. <http://doi.org/10.1037//0033-2909.128.1.118>.
- Whitmore, E. A. W., Kramer, J. R., & Knutson, J. F. (1993). The association between punitive childhood experiences and hyperactivity. *Child abuse & neglect*, 17(3), 357-366.
- Willoughby, M. T., Williams, J., Mills-Koonce, W. R., & Blair, C. B. (2019). Early life predictors of attention deficit/hyperactivity disorder symptomatology profiles from early through middle childhood. *Development and psychopathology*, 1-12.
- Wolfe, D. A., Crooks, C. V., Lee, V., McIntyre-Smith, A., & Jaffe, P. G. (2003). The effects of children's exposure to domestic violence: A meta-analysis and critique. *Clinical child and family psychology review*, 6(3), 171-187.
- Woodward, L., Taylor, E., & Dowdney, L. (1998). The parenting and family functioning of children with hyperactivity. *The Journal of Child Psychology and Psychiatry and Allied Disciplines*, 39(2), 161-169.
- Zhang, F., Pant, D., & Logan, B. E. (2011). Long-term performance of activated carbon air cathodes with different diffusion layer porosities in microbial fuel cells. *Biosensors and Bioelectronics*, 30(1), 49-55.